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ADDRESS AT THE ANNUAL GENERAL MEETING

of the Society held on 18 October 1937, by the President

PROFESSOR HENRY BALFOUR, F.R.S.

IT is a privilege of the President, at the Annual Meeting, to pass briefly in review the chief events which have occurred during the twelve months which have elapsed since the last similar occasion. In making use of this privilege I will endeavour to be brief, in order not to detain you unduly.

The outstanding event of the year—one which affected not only our Society, but the whole British Empire—was the accession to the Throne of His Majesty King George VI, followed by the Coronation of Their Majesties on May 12. It was my privilege to represent the Society at the most impressive ceremony in Westminster Abbey, and to be present, by invitation of the Admiralty, at that wonderfully organized pageant, the Naval Review at Spithead.

During the period of the festivities the Society's House was suitably and effectively decorated. An afternoon Reception of distinguished overseas visitors was held in our premises and was well attended. The Society has been honoured by His Majesty's gracious acceptance of a loyal address and by His decision to continue in His Person the Royal Patronage which the Society has enjoyed since its inception. By a further act of grace King George has consented to grant annually the two highest and most coveted Geographical Awards—the Founder's and the Patron's Gold Medals. May I take this opportunity of reiterating our deep and unshakable feeling of loyalty towards our Reigning Sovereign and His Gracious Queen.

It is inevitable that I should refer to the many and serious losses which the Society has suffered during the year. The regrettably long death roll includes many distinguished friends and Fellows, whose names will be held in high honour.

Major-General Sir Percy Cox, our late President, who occupied the Chair at our last Annual Meeting, had acquired great and well-merited fame from the conspicuous success which attended his administrative activities in and around the Persian Gulf, first as Consul-General at Bushire, then as Political

Resident in the Persian Gulf, and, finally, as the first High Commissioner for 'Iraq. The real monument to his memory stands in the Near East, where his brilliant gifts, tenacity of purpose, and his flair for winning the confidence and respect of the Arabs, will long be held in grateful remembrance. His activities did not cease on his retirement, for he placed his services at the call of the Society, whose interests he promoted wholeheartedly, working untiringly on its behalf and finally presiding over the Society with much distinction. As chairman of the Mount Everest Committee he was instrumental in promoting and organizing the expeditions of 1935 and 1936, whose objective it was to attack that difficult and hitherto impregnable peak. He was a keen ornithologist and an enthusiastic horseman. Indeed, his end came while he was in the hunting field, and with it there passed away a distinguished and lovable character who had been a Fellow of the Society for more than forty years.

By the death of *Lord Conway of Allington* we have sustained another very serious loss of an old friend whose Fellowship dated from 1893, and who had served for many years on the Council. One of the most versatile of geniuses, he combined a passion for mountain-climbing and exploration with an equally live passion for art and literature. His climbing exploits were achieved in many widely separated regions. Conway's 'Guide to the Alps' is not only a record of his own exploits, but has served as an aid and also as a stimulus to generations of climbers. He was a pioneer surveyor in the vast Karakoram district, an explorer of the Bolivian Andes, of Tierra del Fuego, and of the interior of Spitsbergen. His valuable geographical work won for him the Patron's Gold Medal. His love of art persisted throughout his life. He was known as a connoisseur and as a discriminating collector of works of art, and he filled the post of Professor of Fine Art both at University College, Liverpool, and at Cambridge. His restoration of the derelict Allington Castle was a triumph of reconstruction and scholarly ingenuity. His familiar figure will be sadly missed from our meetings.

Sir Albert Kitson was noted as a geologist and as an archaeologist. His chief work was connected with the Geological Survey of Victoria, Australia, and, later, with geological surveys in Nigeria and the Gold Coast; but his travels and researches covered a far wider area. Incidentally, he made a large and valuable collection of implements of the African Stone Age.

Mrs. Eleanour Elkins Rice was one of the Society's most generous benefactors and a frequent attendant at our meetings. Herself an enthusiastic traveller, she was married in 1915 to one of our Gold Medallists, Dr. Hamilton Rice; and one of their joint exploits, involving two separate journeys of exploration to some of the northern tributaries of the Amazon, has been assessed very highly in the field of geographical research. When funds were being sought for the extension of the Society's premises, including the splendid Hall in which we are now meeting, Dr. and Mrs. Hamilton Rice came forward nobly with a subscription which headed the list doubly, by being at the same time the first and the most generous of all the donations to this fund.

John Hardwick Reynolds was, during the Great War, a vigorous and extremely able volunteer worker on the Society's staff. He was subsequently engaged upon the compilation of the one-in-a-million map of Europe and

the Near East. Later his interests were concentrated upon the work of the Permanent Committee on Geographical Names, of which he was appointed secretary and for which he worked devotedly even under the stress of ill-health. His linguistic attainments were of the greatest value, and, indeed, his loss is one which is not easily made good.

Mrs. Frances Emily Weston is chiefly associated in our minds with Japan and with many exploratory mountain ascents which she made in company with her husband, the celebrated British chaplain in Japan, the Rev. Walter Weston. She was devoted to Japan, its scenery and its people, and a great admirer of that country's art. Her humanitarian instincts found an outlet also at home, where she worked self-sacrificingly on behalf of the Mission to Seamen.

Brigadier-General H. H. Austin, who joined the Society as a Fellow in 1893, will be remembered for valuable work performed both in India and Africa, where he conducted preliminary surveys for railways on the Indian frontier and in Uganda. But his services were manifold, including a survey of the western shores of Lake Rudolf and of frontiers in East Africa, varied with military duties as a combatant officer.

Miss Bessie Pullen Burry is one whose familiar face will be missed at our meetings, which she attended with great regularity. She was an enthusiastic traveller in many parts of the world, including northern New Guinea, and she was particularly interested in Negro problems. Miss Pullen Burry was very instrumental in stimulating in others an interest in geographical science, and was the first President of the first Union of Women associated together in furtherance of the subject.

Geoffrey Swinford Laird-Clowes, formerly Political Officer and Chief Inspector of Survey in Egypt, was well known as an authority on naval architecture, and, as Assistant Keeper in the Science Museum, was largely instrumental in developing the splendid marine section of that Museum with its magnificent collection of models of sea-craft of all nations. He was a past-president of the Kosmos Club.

Lieut.-Colonel Francis Richard Maunsell carried out extensive exploration work in the Near East, notably in Turkey-in-Asia and in Kurdistan. He was seconded by the War Office for work upon the pre-war map of Asia Minor. In this he was brilliantly successful in spite of the meagreness of the material then available.

Joseph Terence Owen Barnard served for many years on the north-east frontier of Burma. He was in charge of the first and later expeditions to Mkamti Long, and, as Political Officer, he led expeditions into the Hukaung Valley and the Triangle, in the northerly extension of Burma, with the objective of ensuring the suppression of slavery in those areas. Conspicuous success attended his efforts.

Arthur Winston Moore, who died at the early age of twenty-seven, was an enthusiastic and very promising explorer, who took part in two of the Oxford University Exploration Club's expeditions. One of these was to Sarawak, where, among other achievements, he made a first ascent of Mount Kalulong. The second took him, by contrast, to Ellesmere Land. In the course of that expedition he, in company with Sergeant Stallworthy, made a plucky and

arduous sledge journey across the greater part of Grant Land, in the course of which a new and lofty range of mountains was discovered.

Dr. William Hunter Workman, whose death at the age of ninety was announced but a week ago, was a wide-ranging traveller and explorer, with a passion for high altitudes and mountaincering adventure in out-of-the-way regions. North Africa, Java, Northern and transfrontier India were all scenes of his exploits. He made, with his intrepid wife, many important ascents in the Himalaya and in the Karakoram district, and his record of captured peaks is a long one.

If time permitted one might easily extend further these summary notes upon some of the distinguished Fellows of the Society who have passed away during the year. But these names will suffice to indicate the variety of geographical interests represented by those whom we have lost; while the regrettable length of the whole obituary list is a reminder that it is very essential for us to endeavour to make good our losses and to maintain and, if possible, increase the membership strength of the Society, in order that our activities may not be curtailed but rather augmented with the help of funds derived from subscriptions.

It is gratifying to learn that some of those who are now missing from our ranks have desired posthumously to pay tribute to their faith in the Society's usefulness. The following three benefactions are to be recorded: £100, free of legacy duty, bequeathed by the late Mr. Stenton T. Covington; £500, free of duty, bequeathed by the late Mrs. Viva Jeyes; and £1000 in Stocks bequeathed by the late Miss Julia Lindley, one of our most loyal supporters. One cannot but feel very grateful to those who so generously testify to the fact that they have derived pleasure and benefit from their membership. Such acts of generosity are of great value as a means of building up a substantial financial background and in creating a reassuring state of stability.

In regard to the welfare of the Society, it is very pleasing to note that we are gradually recovering from a period of depression, evidenced by a succession of lean years since 1931, during which our membership steadily declined and, consequently, our income became reduced. In 1936 there was a marked increase in the number of Fellows elected, and the financial position has been such as to convert the adverse balances of the previous three years into a fairly substantial balance on the right side. The excess of income over expenditure amounted to about £1300. It seems likely that in the near future the ravages of the three lean years will be made good and that the Society may be able to increase its activities under improving financial conditions. We have some way yet to go ere we can regain the high-water mark of our membership of the year 1930; but the "outlook is mainly fair." Signs of increasing interest in matters geographical are to be seen in the much greater use which is now made of our splendid Library, as is noted in the Annual Report; while evidence of a keen desire to further geographical exploration and research in the field is manifested by the unusually large sum which was allotted to aid expeditions during the past session. Since the encouragement of field work is one of our principal objectives, it is reassuring to note that a larger sum than usual was able to be devoted to that purpose.

I will now refer briefly to the Expeditions in which the Society is interested, which have been in operation during the past twelve months:

The *British Graham Land Expedition*, under the leadership of John Rymill, has returned after spending some two and a half years in the Antarctic. They have throughout worked strenuously under conditions of severe climatic stress, and their harvest of new and important observations and of new areas surveyed is great. As the first meeting of our new session is to be devoted to an account of this very satisfactory exploit, I will not attempt to detail the results obtained. But I would refer to the pleasing fact that no serious casualties occurred during this very prolonged sojourn in a most inhospitable region, and that the entire personnel returned safely and seemingly all the better for a great adventure. Surely, a triumph for leadership and organization! I also would mention that the finances of this great expedition, after having given cause for anxiety, have now been placed on a sound footing, mainly through the great generosity of Lord Wakefield, who has contributed a very large sum which practically wiped out the deficit, and restored financial equilibrium.

Mr. Ronald Kaulback, who was accompanied by Mr. N. J. F. Hanbury Tracy, completed his valuable exploration of the Salween Valley and surrounding areas in south-east Tibet, where some 50,000 square miles of territory were surveyed and important collections were made. The friendly contacts which were made with the Tibetans and other occupants of the region are a pleasing feature of this noteworthy enterprise.

Consul Lars Christensen, the Norwegian whaling magnate and one of our Life Fellows, has returned from another of his expeditions to Antarctica. He was accompanied by his wife, who is an experienced navigator, and by Herr Wideroe, an expert airman. Using one of his own whaling factory ships as a base and transport, an extensive air survey was made of the section of the Antarctic Continent between Enderby Land and the Weddell Sea. Much new land was discovered and new peaks and mountain ranges, a material addition to the steadily developing map of Antarctica. I am glad to say that Mr. Lars Christensen has promised to give an account of this enterprise during the coming session.

A very ambitious mountaineering achievement, worthy of special mention, has been the first ascent of the Himalayan giant, Chomolhari, by *Mr. F. Spencer Chapman*, last May. Chapman was obliged to dispense with most of his porters at a relatively early stage, and, when a height of 21,000 feet had been reached, his companion, Mr. C. E. Crawford, and one of the two remaining porters, had to leave him. With the one remaining porter, Passang, Chapman went on, poorly equipped, and successfully reached the summit (24,000 feet). He had overcome very great difficulties and performed a remarkable feat of climbing and endurance, and, withal, at an incredibly small financial cost.

In the last few days we have received the news of the return of *Mr. F. S. Smythe* from another of his Himalayan adventures, in the course of which he scaled a number of important peaks. Weather conditions frustrated his attempts upon other mountains and cheated him of other successes. He made a valuable botanical collection in the Himalayan area.

That indefatigable explorer, *Sir Aurel Stein*, has brought to a successful

conclusion yet another of his epoch-making and scholarly feats of exploration in Central Asia (1935–36), which has yielded a mass of important new information, of value both from a topographical standpoint and historically. On this last exploring journey he travelled from Shiraz through the Iranian provinces of Khuzistan and Luristan, and was once more on the track of Alexander the Great. Of special interest are his researches into the effects of these ancient western contacts upon eastern cultures. In this field of inquiry he is supreme. He also made tentative excavations of sites which reveal remains of a chalcolithic culture. The publication of his full results will be eagerly awaited.

Mr. H. St John Philby is back again amongst us after making another very profitable research journey through Arabia. On this occasion his journey was by motor car, and he traversed Arabia from north to south, at the request and under the aegis of King Ibn Saud, who desired a survey of the southern portions of his kingdom. The prospect of being able to visit Shabwa and its neighbourhood, once the great centre of Himyaritic culture and administration, was eagerly seized by Philby, who ultimately achieved this objective and made a survey of what remains of the former glory of the town. As he learned afterwards, he was not actually the first European to enter Shabwa: he had been forestalled, in 1935, by a young German, Hans Helfritz, who made a plucky and surreptitious entry by night and narrowly escaped with his life in the morning. Unlike his predecessor, Philby received a welcome, and his was a "peaceful penetration." At our second evening meeting we are to be treated to an account of this journey (The Seventh Asia Lecture).

The return of *Mr. J. M. Wordie's Expedition* was announced very recently. The expedition sailed in June last, and has carried out some valuable experiments with miniature balloons for the study of cosmic rays in the neighbourhood of the Magnetic Pole. In addition, a rapid survey was carried out along the north-east coast of Baffin Land, resulting in the discovery of several hitherto unknown fjords and islands. A visit was also paid to Ellesmere Land and the Bache Peninsula. One of the expedition's very important results was obtained by excavation in ancient Eskimo settlements from which a very large collection of relics of early Eskimo culture was obtained. This collection may throw great light upon the affinities and migrations of the Greenland Eskimo.

One more returned expedition should be mentioned. A large party of schoolboys has once again been given the opportunity of acquiring a taste for and a training in geographical research. Under the auspices of the *Public Schools Exploring Club* the party, very ably organized by Commr. G. Murray Levick and Mrs. Levick, made a considerable and successful tour in a little-known region of Western Newfoundland. Surveying operations, collecting natural history specimens, and observations were carried out with enthusiasm. We may hope that the excellent scheme which was initiated by Commr. Levick may prove far-reaching, and, in addition to inculcating a taste for geographical research and adventure, may ultimately help to swell the ranks of expert, scientific travellers.

The expedition led by *Mr. Eric Shipton*, who has as his co-travellers, H. W. Tilman, J. B. Auden, and Michael Spender, is now, I believe, on its

way home in detachments. Their objective was the Shaksgam Valley in the Karakoram region. Their survey of a very wide area has been completed with signal success and an important hiatus in the Karakoram map has now been accurately filled.

There are two matters of special interest to the Society to which I must make reference. Both of them have significant bearing upon the objective of the expedition which I have just mentioned. The first of these is the completion to date of the Society's Map of the Karakoram—itself an exquisite example of plotting and draughtsmanship—and the final agreement which has been reached as to the nomenclature to be adopted, expecially in filling in the range-names. Over this question of nomenclature there has been a long discussion, dating from 1928. After many conferences the divergent views expressed have been finally harmonized. The draft proposals were forwarded to the Surveyor-General of India for his approval, and, at the end of August I received a letter from him stating that the recommendations of the Committee on Karakoram nomenclature had been, after careful examination, formally approved without qualifications of any kind.

The second matter of particular interest in connection with this area relates to an achievement of half a century ago. Early in September 1887 a subaltern in the King's Dragoon Guards made a memorable journey from Peiping to India, the later stages of which, after he had reached and left Yarkand, involved making a new traverse opening up a more direct but hitherto unexplored route as an alternative to the known route over the Karakoram Pass. That subaltern was Francis Younghusband, who is now one of our oldest and most honoured Fellows, and a past-president of the Society. He has thus reached the fiftieth anniversary of this early exploit, and it is only fitting that his exploring achievement, which was followed by so many other striking evidences of his initiative, courage, and capacity for overcoming difficulties, should receive special mention and be the subject of cordial congratulations. Briefly, his objective was to explore and survey the old but long-discarded trade route across the Mustagh Range to Baltistan. Travelling with very light equipment and with thirteen ponies and eight natives (one of whom thought that he could remember the way), and encountering many obstacles, he crossed the Aghil Pass and reached the Shaksgam River. Thence he traversed the Mustagh Pass, with its difficult glaciers and ice-slopes, to Askoli, and finally passed through Baltistan to Rawalpindi, which was reached seven months after he had started from Peking. The journey was described in his book 'The heart of a Continent,' and it is pleasing to learn that a new edition is shortly to appear. It will be welcomed as an appropriate epilogue to the "Golden" anniversary of a sterling exploit.

Of expeditions which are still in the field may be mentioned the *British Canadian Arctic Expedition of* 1936, led by T. H. Manning, who is conducting a three-years' survey on and around Southampton Island. His four companions, who have reached the limit of their available time, have returned, but Manning is continuing his exploratory work by himself, with the intention of remaining until 1939. The collective results should prove of high importance.

Also in the field is the expedition of *David Haig Thomas, J. W. Wright,*

and *R. A. Hamilton* to North-West Greenland and Ellesmere Land, with the primary object of continuing the surveys and natural history investigations which were initiated by the Oxford Ellesmere Land Expedition.

While passing in brief and summary review these recent geographical explorations and researches of our own explorers, I cannot refrain from making reference to the grievous disaster which brought to an abrupt end the well-organized and plucky attempt by a German expedition to make a first ascent of the Himalayan peak, Nanga Parbat. The party was overwhelmed by an avalanche on June 15, and seven German mountaineers and nine Sherpa porters lost their lives. There were but two survivors. The leader, Dr. Karl Wien, who perished with the others, had visited our Society's premises about a year previously, and had expressed his high admiration of British mountaineers and surveyors. We well may share the feeling of bereavement which has stirred the hearts of the German nation through the loss of these valuable lives. Our deep sympathy is with the German people, but the loss is felt by the whole mountaineering fraternity.

There are certain events to which I may now turn as affording satisfactory testimony to the Society's activities.

The Permanent Committee on Geographical Names, the progress of whose work had been retarded by lack of funds, has taken a fresh lease of life under a stimulus afforded by the Lord Commissioners of the Admiralty, who, with the consent of H.M.'s Treasury, have offered an annual contribution of £300 for a period not exceeding ten years in support of this useful work. In spite of the grave loss sustained by the Committee through the death of Mr. Reynolds, their indefatigable secretary, it is hoped that the work may go forward with renewed vigour, a hope which is the more sanguine since we have learned of the greatly improved health of the Chairman and chief promoter of the inquiry, Lord Edward Gleichen.

Considerable satisfaction may be felt at the conclusion of the negotiations with the directors of the *Geographical Magazine*. After delays which could not well be avoided, an agreement has been come to, approved by the directors of the company and by this Society, and the trust deeds have been duly executed. It only remains to wish a prosperous career to the magazine, which has already gone far towards widening the popular interest in matters geographical. Financially, the Society stands to gain indirectly by the company's success, by an increase in the funds which can be allotted to exploration; but our interest in its welfare is primarily aroused by the fact that the *Geographical Magazine* occupies a definite place in British geographical literature and meets a long-felt want.

Another publication to which reference should be made is the invaluable handbook 'Hints to travellers,' which, in the able hands of its compiler, Mr. A. R. Hinks, is now rapidly approaching completion, and should shortly be in the hands of every serious traveller. The compiling of this work from the masses of relevant material available has been very arduous and has required great selective skill. Mr. Hinks is to be congratulated upon having reached the last stage of his responsible and strenuous task.

The recent appointment of a Standing Committee of the Society for the supervision and organization of Instruction in Survey, is a move in the right

direction, calculated to advance and stimulate this important branch of applied geography.

I will refrain from detailing the list of lectures which have been delivered during the past session. The list is published elsewhere. Suffice it to say that we have endeavoured to deal as far as possible with very many branches of our hydra-headed and versatile science. We have ranged from the North Polar regions to Antarctica; from Everest to the Tennessee Valley; and from sub-glacial volcanic phenomena in Iceland to seismic destruction in New Guinea. We have been enlightened impartially as to the manners and customs of the Mongols and as to the behaviour of the Peru Coastal Current. Economic ventures have been dealt with, such as the search for practicable motor routes, and successful attempts to render habitable by Europeans the inclement areas of Arctic Siberia.

These and other varied topics have all come within the ambit of our thirst for knowledge. I think that the Society can claim credit for a certain degree of versatility; while those responsible for the sessional programme may claim to have ministered to a wide variety of tastes.

I referred a little while ago to the recent occurrence of a fiftieth anniversary. Before I conclude this Address, I would like to refer to another jubilee celebration which is very shortly to be held. On November 4 the Tyneside Geographical Society will celebrate the completion of the first half-century of its active and useful life. We shall, I am sure, desire to offer hearty congratulations to our already old-established, though still relatively junior colleague, and will wish the Tyneside Society many more half-centuries of prosperity.

Our own Society can boast a history of 110 years of continuous existence. In spite of its great age, I think that we may rest assured that its vigour is in no way failing. There are no threatenings of incipient senility. On the contrary, the wide range of its present-day activities and interests and the numerous operations in which it is involved, are the very factors which have imposed upon me the difficult task of trying to keep my survey of the year's events within reasonable limits.

I will now use a Chairman's privilege, apply the closure, and thus relieve your patience from the tension to which it has for so long been subjected.

THE CULBIN SANDS AND BURGHEAD BAY

J. A. STEERS

Afternoon Meeting of the Society, 8 November 1937

THIS paper deals with the stretch of coast between Nairn and Burghead, one unit of the extremely interesting shores of the Moray Firth. A. G. Ogilvie[1] has written the most comprehensive paper on recent changes along the coasts of the Firth. The present paper is related to his work, but deals in greater detail, and from a different point of view, with a selected area. Much new and careful mapping was carried out in the summer of 1937, and quite apart from material not touched upon by Ogilvie, the new maps make interesting comparisons with his. Much of the sand has been redistributed and new exposures have been laid bare.

Apart from Ogilvie's paper the area has been discussed in somewhat general terms by T. Wallace and other writers. These early papers however dealt with the problem descriptively and not on a genetic and evolutionary basis. A great deal has been written about the Culbin[2] Sands, but mostly from an historical point of view. The final inundation by sand in 1694–95 has naturally aroused great interest, but with the exception of the relatively small part of Ogilvie's paper which deals with Culbin and parts of the papers by Wallace, little has been written from a physiographical point of view.

It is unfortunate that no map is known to exist of the Culbin estate before the inundation, so that it is impossible to know the precise distribution of houses and farms. It should however be remembered that Earnhill was not despoiled. Naturally much exaggeration has happened in course of time, but we cannot any longer believe that all the destruction took place in one storm.

In writing of the Culbin foreland it is necessary, as will be shown later, to take into account the coast to east and west of it. Burghead Bay is, in this sense, an integral part of the problem. As this paper is not concerned primarily with glacial and post-glacial oscillations of sea-level (which have been fully described by Ogilvie), comparatively little attention has been given to the question of raised beaches as such. It is convenient to regard the visible outcrops of the Old Red Sandstone at Nairn and the Permo-Triassic at Burghead as the western and eastern limits of our area. Landwards the 50-foot contour has been taken. It corresponds closely with the sea cliff of the 25-foot sea, but the cliff is sometimes in front of the contour. However it makes a definite, if arbitrary, limit and eliminates overlap with writers on the solid geology.

[1] *Trans. Roy. Soc. Edinburgh*, LIII, 1923. This paper contains some important original maps (made in 1913) of several parts of the Firth. Those referring to the area dealt with in this paper should be consulted, as interesting comparisons of changes can be seen. It is essential to realize that east of Findhorn Bay vast amounts of sand have been redistributed, and throughout the whole area far more shingle is visible now than in 1913.

[2] The word "Culbin" means "back of the hill." (See W. J. Watson's 'Place-names of Ross and Cromarty.') It is not known which hill is referred to.

Much of the area discussed is under blown sand and forest, so that it is often difficult to obtain local details. Low Wood has been traversed several times and only sand has been found either on the surface or in artificial drains. It is believed that all the shingle ridges, which give the main clue to the evolution of the area, have been found and considered. The Bar has never yet been described: it is a most interesting structure and links on to the historical evidence of the changes in the mouth of the Findhorn.

If the whole area north of the 50-foot contour is visualized at the time when the 25-foot sea was cutting its cliff, we see a wide open bay broken here and there by islands of glacial material, *e.g.* Grange Hill and the esker of Milton Brodie and Upper Hempriggs. There is every reason to believe that this was a shallow bay into which the river Findhorn and the westerly directed waves and currents continuously brought material. In this shallowing bay, aided by the fall of sea-level from the 25-foot stage through the 15-foot stage to the present day, extensive sand-flats and shingle forelands accumulated. The early course or courses of the Findhorn are unknown. It may at one time have run westwards behind the great Culbin Shingle fan as suggested by Craig.[1] Craig however took no account of this shingle, and there is no means now, short of boring, of establishing definitely any of these old river beds. Again, as all the material in front of the 50-foot contour is soft there are no definite remains of the 15-foot beach in this area. Undoubtedly many of the older shingle ridges belong to this episode but it is not at all easy to draw any dividing line between them and those belonging to the 25-foot stage.

The whole area has been in occupation for a long time, and remains of the Neolithic (Tardenoisian) and later periods have been found in great quantities. Historical evidence, apart from the Culbin estate and Findhorn town, is difficult to obtain and may not exist. There are memories of a former settlement at Maviston,[2] which seems to have been situated on the foreshore more or less due north of the present Maviston Farm. It was however unimportant and was merely in the nature of a fishing hamlet. It is not improbable that its decay is related to the south-westward growth of The Bar. A small settlement at Findhorn Hill, on the west of Findhorn Bay, also existed before and after the great inundation.[3]

The two great physiographical processes, apart from change of level of land and sea, which govern the area are the westerly winds carrying the sand eastwards, and the beach-drift and tidal currents which both carry material to the west and south-west.[4] The former has led to the growth of dunes, the latter to the formation of shingle ridges. Here, just as in north Norfolk, the

[1] *Trans. Geol. Soc. Edinburgh*, V, 1888.

[2] G. Bain, 'The Culbin Sands.' Illustrated edition: "Nairn Telegraph" Office (no date).

[3] J. G. Murray, 'Old Findhorn' (pamphlet, no date).

[4] The river Findhorn, and the material it carries down with it, may also be added. (See also G. Bain, 'The river Findhorn from source to sea.' 4to. Nairn, 1911.) The tidal currents along this part of the coast set towards Inverness Firth. The major direction of beach-drift is similar, as a result of winds from between north and east blowing over the longest stretch of open water. The prevalent winds, responsible for the dunes, are from west, south-west, and south-south-west. The dominant winds average roughly north-east; these are responsible for the movement of beach material.

dominant wave approach is from between north and north-east, with local deviations as, *e.g.* immediately south of Burghead. How these several factors have worked to bring about the present disposition of features is the main thesis of this account.

The Culbin Foreland

It may be taken for granted that the whole Culbin foreland, and similar adjacent parts of the coast, originated first as sand-flats. On that part which was to become later the Culbin estate a complex system of shingle ridges developed. With the fall in sea-level to that of the present day this area became dry land. From what can be seen to-day, it is clear that blown sand soon covered much of the region, and in time a soil formed. Traces of this soil can still be seen. It was at one time well cultivated and it is still possible to see the old rigs in places. Sufficient traces are not visible to enable a final statement to be made, but generally it would appear that the cultivated land was inside and partly west of the major shingle fan, although it certainly covered most of the ridges.

The Culbin area was habitable in quite early times.[1] Large collections of finds have been amassed by archaeologists, mostly amateurs, but it has proved almost impossible to carry out a complete archaeological examination on a stratigraphical basis. Apart from haphazard collecting a natural difficulty has also intervened. Remains of all, or nearly all, ages represented on Culbin may be found at the same level. The underlying beaches contain flint nodules,[2] the original source of arrow-heads. But the covering sand has from time to time been eroded, and the articles of more recent occupations which existed on the sand levels have dropped down to beach levels, and so old and new implements occur intermixed. Apart from the implements found, there are also shell-heaps, or kitchen-middens. These consist almost entirely of the remains of edible molluscs, *Mytilus*, *Cardium*, *Ostrea*, *Buccinum*, *Patella*, and *Littorina*. The presence of *Ostrea* is interesting. It thrives in a rather muddy habitat and up till quite recent times was much sought after. Now it has disappeared from the coast. The most probable explanation is that the increasing amount of sand has made the region unsuitable for it. Some of the shell-heaps also show in their central parts the traces of a hearth or fireplace. These shell hillocks occur in many places, but perhaps the most conspicuous one is about three-quarters of a mile from the mouth of the Findhorn. This is probably the one described by Pirie [3] as containing "layers of shells, alternating with layers of sand, the shell beds being from nine inches to three feet in thickness, and the intervening layers of sand from six inches to two feet in thickness." In addition to the arrowheads there have also been found bronze articles and ornaments, a bloomery with iron slag, and coins.

The first known owners of the land were the de Moravia family. Richard

[1] See papers in *Proc. Soc. Ant. Scotland:* vol. XI (H. Linton), vol. XII (A. Matthewson), vol. XXV (G. F. Black), and vol. XLV (J. G. Callander). Also vol. LIV (J. G. Callander) and vol. LXIII (Mrs. Dunbar Duff) on sites east of the Findhorn.

[2] There is no certain explanation for the occurrence of natural flints on this shore, but it is generally thought that they have been carried to it by floating ice from a submerged Cretaceous outcrop in the North Sea.

[3] *Elgin Courant*, 22 July 1884.

The Culbin sand-hills, 1909. Old land surface swept clear of advancing sand

Geological Survey photograph, reproduced by permission of H.M. Stationery Office

Old plough land, Culbin

North end of The Bar: marshes to right, sand-flats and open sea to left

Burghead Bay. Shingle cliffs in raised beach deposits, with modern dunes above

Moray, brother of Gilbert, fourth Bishop of Caithness, grandson of Friskinus, Lord of Duffus, and nephew of Hugh Friskin, ancestor of the Earls of Sutherland, was the first recorded occupier. He lived about 1240. The Morays held the land until the early part of the fifteenth century, when Egidia Moray married Thomas Kinnaird. Alex Kinnaird was the last of this line, and it was in his time, late 1694 or early 1695, that the final catastrophe took place. Before then however the estate was greatly embarrassed. In 1698 it was purchased in the name of Alex Duff, and in 1733 it was sold in Edinburgh for less than one thousand pounds sterling to Sir Ludovick Colquhoun of Luss, who seems to have acted for his uncle Major George Grant of Grant. The Binsness area had a slightly different history and now belongs to Mr. J. Chadwick of Findhorn.[1]

No map or plan is known to exist which shows the farms and buildings of the estate before it was overrun by sand. The Charter of 1586 describes it thus:—"The Mains of Culbin, hill of Findhorn—the ferme coble of the water of Findhorn—the fishing commonly called the Stells of Culbin—the lands of Mackrodder, alias Mirrietown—lands of Aikenhead, alias Ranchkers—the lands of Binn, alias middle Binn—lands of Laik and Sandifield—lands of Delaith, alias Delpottie, with the Mill of Delpottie—the Manse of the Chapel of Saint Ninian—lands of Earnhill—Easter Binn." [2] Most of these places cannot now be located. Earnhill and Easter Binn (Binsness) still exist, the former being a most fertile farm, but the rest are under the sand. The estate originally covered some 3600 acres, and included sixteen fair-sized farms and farm houses [3]; in 1694 the rental was £2720 Scots, 640 bolls of wheat, 640 bolls of bear, 640 bolls of oats, and 640 bolls of oatmeal.[4] In 1733 however the "annual net produce in money" was £494 4*s*. 4*d*. These figures are self-explanatory, and if it is borne in mind that the latter figure includes the Earnhill farm, we can form some idea of the destruction that had taken place.[5] As the sand continued to accumulate and advance in great masses towards the Findhorn, the once fertile region became a desert. For a long time no attempts at reclamation seem to have been made, but in 1839 Mr. Grant of Kincorth began planting conifers successfully. His example was followed by other proprietors, and in course of time the Low Wood covered a large part of the flatter and more fixed sands. This wood, marked on the Ordnance Survey map, was felled at the end of the War. Before the War the late Mr. Chadwick had made some interesting and successful plantations of Corsican pine at Binsness.

[1] See, *inter alia*, 'Antiquarian Notes,' C. F. Mackintosh, Inverness, 1864, p. 31, and also Dunbar's 'Documents.'

[2] From T. Wallace, *Trans. Northern Assoc. Lit. and Sci. Socs.* II, 1896, p. 35, and papers by the same author in *Trans. Inverness Sci. Soc. and Field Club*, esp. vol. II and vol. V.

[3] *Cf.* C. F. Mackintosh, *loc. cit.*

[4] £1 Scots = approximately 1*s*. English, but "purchasing power" values are very difficult to arrive at. Hence comparisons should be made with caution. A boll = 6 bushels.

[5] The Act of Parliament of 1695 anent the pulling of bent also implies that the destruction was not sudden, but had been extending eastwards for some time. The gradual impoverishment of the estate points to the same conclusion. The severe storms of 1694–95 completed the destruction.

In 1921 the Forestry Commission began to acquire land at Culbin and so saved the Low Wood area which would, once the trees were felled, probably have soon reverted to loose sand. The Commission now owns over 5000 acres.[1] Low Wood has been replanted, and the sand and great hills to the east are gradually being conquered, partly by the planting of marram grass (*Psamma arenaria*) and partly by thatching. The latter process consists of laying and pegging on the dunes branches of birch and broom which grow naturally in this district. This is the more effective method, because, as the Commissioners have worked from west to east, it follows that the available sand supply becomes more and more restricted, so that *Psamma* does not thrive too well. It has however gained much ground in the mobile area, and will there help in later reclamation work. Scots pine, Corsican pine, and the Lodge Pole pine are the species used in planting, and the trees have grown most successfully. Stable sweepings are also spread over the thatched areas, and numerous grasses and weeds are helping to bind the sand. Small trees, two or three years old, from the nursery, are planted 4 to 5 feet apart on the fixed sand. Later these are thinned out, and the felled trees used mainly for pit props. The Corsican pine has been found the most suitable for the less fixed dunes; Scots pine thrives well on shingle and stable sand areas; and the Lodge Pole pine grows almost anywhere. The only places presenting real difficulty to planting are the low swampy areas. Many of these occur, and may contain shallow lochs in winter, but one result of increased planting has been a marked drying of the whole area; even Buckie Loch, which looks so conspicuous on the map, is almost dry in summer.

Whilst the afforestation has once again made Culbin a valuable national asset, and in the course of another two or three decades will probably have conquered the big mobile dunes, the physiographer cannot help regretting that the nearest approach to a desert in the British Isles is rapidly disappearing. Even now mapping of the shingle and other features is difficult; in a few years it will be virtually impossible.

The dunes of Culbin

The dunes of Culbin rest on the shingle foreland, and cover, or formerly covered, most of the ridges. The major dunes are relatively isolated masses. Typically they are oval in outline, but their lower parts so often merge with flattish sand areas that it is really only their higher parts that can be properly described. It is for this reason that 30 feet is the lowest form-line shown on Mr. Fisher's map (*cf.* Ogilvie's map, *loc. cit.*). There are also so many small peaks, both of accumulation and erosion, that the insertion of form-lines at less than 30 feet, or even 40 feet, is impracticable. But the shapes of the higher dunes, though they may alter rapidly, are interesting and the form-lines shown on the map are sufficiently accurate for this purpose. The major dunes are generally situated transversely to the prevalent winds. Their arrangement can best be seen on Mr. Fisher's map (see folding plate).

[1] For a short but authoritative account of the planting, see *The Scottish Field*, January 1936 (article by Dr. H. M. Steven). The writer is also much indebted to Mr. Warren of Elgin for demonstrating methods of afforestation in the field and for lending him the special (unprinted) forestry map of the Culbin area.

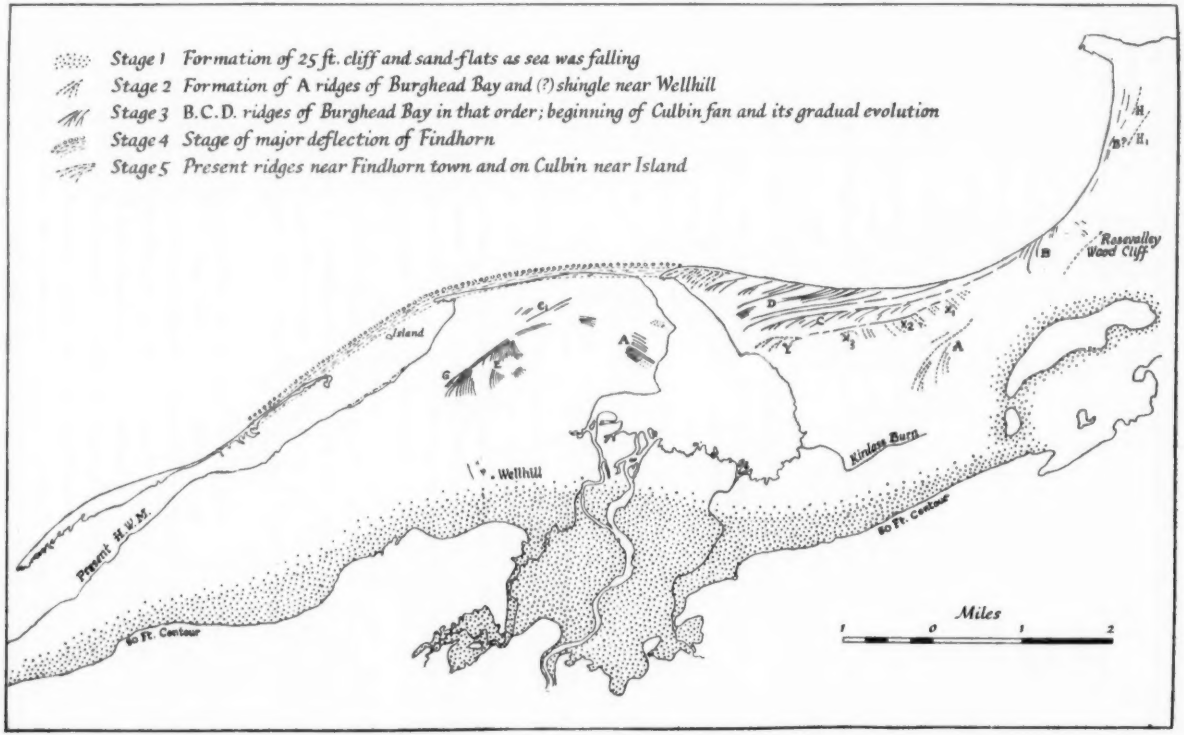

Stage 1 Formation of 25 ft. cliff and sand-flats as sea was falling
Stage 2 Formation of A ridges of Burghead Bay and (?) shingle near Wellhill
Stage 3 B.C.D. ridges of Burghead Bay in that order; beginning of Culbin fan and its gradual evolution
Stage 4 Stage of major deflection of Findhorn
Stage 5 Present ridges near Findhorn town and on Culbin near Island
Island
Wellhill
Kinloss Burn
Present H.W.M.
50 Ft. Contour
50 Ft. Contour
Roseisle Wood Cliff
Miles
1 0 1 2

Fig. 1. Schematic map of Culbin and Burghead Bay

The first, and most obvious point, is the gradual windward slope as contrasted with the steeper leeward slope. But it is difficult on a map to bring out this contrast as it appears in the field. On any big dune the windward slope is, as a whole, convex, but it is not a smooth curve. A detailed section taken in almost any direction would show a form similar to that shown in the diagram. At A and B (see Fig. 2) there are minor dunes climbing up the major dune. In plan these minor forms are roughly crescentic and their leeward slopes are steep. They are the result of wind-blown sand gradually creeping up the big hill. On the leeward side of a big dune the slopes resemble those in Fig. 2. It is seldom that the whole leeward slope of a major dune is continuous for any distance. It is broken, as indicated, by steps. These steps may be perhaps 20 feet to 30 feet in vertical height, but are usually less. They stand at the angle of rest of the fine sand, and the least touch sets the sand in motion. These steep slopes are often seen advancing on to the flats in front of them.

The form of a major dune often, but by no means always, resembles that of a crescentic dune. This is not always obvious at first sight in the field, but is brought out to some extent by mapping and becomes clearer when one knows the area well. This necessarily applies to the part of the dunes above,

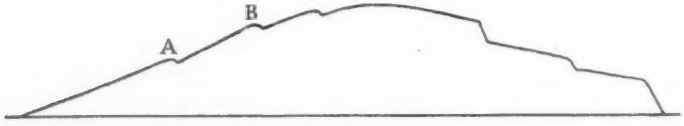


Fig. 2. Cross-section of a major dune

approximately, the 30-foot form-line. The shape is far removed from that of a true barchan, but it is only necessary to point out that on Culbin the dunes do not rest almost independently on bare rock, and that whilst they are formed in the main by the prevalent westerly winds, they are greatly modified by the fewer but often stronger easterly and north-easterly winds.

One feature characteristic of some of the larger dunes, for which no clear explanation is apparent, is that they have two summits. These, and all summits of big dunes, are rather flat but perfectly distinct. It may be that two dunes have coalesced, but this does not seem likely as, when found, they cap a single dune mass.

A fact that may be stressed is that where the big dunes are noticeably advancing on to a flat, the steep slope, *i.e.* of the angle of rest of sand, reaches directly down on to the floor which may be shingle or turf, without any break of slope or "apron." In other words, there is a distinct break of slope at the bottom of the advancing dune, and no gradual rounding-off such as might seem to follow if an eddy current is visualized. Loose material, feathers, etc., are sometimes to be seen moving up this steep slope, indicating an upward air motion, but as far as could be seen this current has no erosive action in fair weather, and has no effect on the slope. Lastly, the fine rippling of the sand by the wind may be noticed: it appears always to be transverse to the wind causing the ripples.

The dunes, especially along the northern shore, are for the most part ordinary fore-dunes, running roughly parallel with the coast, but sometimes rather obliquely to it. When this is the case the dunes are usually found to border low areas in which shingle may occur. They are much less regular in form and, as on many another coast, are cut into hollows. Isolated peaks may reach 60 or more feet in height.

Occasionally parabolic dunes are seen. In these the less massive sides have been held by vegetation more firmly than the barer and higher parts which have therefore advanced farther. Hence in plan these dunes are the reverse of the barchan shape, and generally they are somewhat irregular: they are really elaborate "blow-outs." Not far east of the flag-staff on the northern shore a striking case may be seen. What appears to have been an ordinary, though somewhat wide, dune ridge running approximately south-west to north-east has been cut into by the wind at its south-western end. This cut increased and tore away the whole middle part of the ridge, so that the sand at the north-eastern end is now advancing on to the beach. Many examples of blow-outs and small parabolic dunes are seen in the wooded areas, especially near the northern shore. Those at Maviston are noted below; they are also common along Burghead Bay.

New dunes have of recent years accumulated at the point facing The Island; and for some distance eastwards along this part of the shore new fore-dunes have recently grown, though they often show signs of minor wave erosion. In the bay south and south-east of The Island blown sand is helping to form the marsh and many minor dunes occur.

In many places in the dune area there are excellent examples of remanié forms. They are merely the remnants left of former dune ridges which have been eroded by the wind. Many are now hidden in the woods and plantations. These and others are not shown on the map as they are nearly all small. In several of the patches in the woods erosion is again evident, often beginning as a rabbit-burrow or a gash made by some one walking over the dune. These gashes are, if serious, thatched by the foresters, otherwise trees would sooner or later be uprooted.

To the south of, and also partly covering, the ridges A and A2 (see folding plate) there is to be seen an old dune area now suffering erosion. None of these dunes attains any great height, and they have been omitted for this reason. At one time Findhorn Hill Wood covered a large part of them. This wood was felled some years ago, and the wind regained mastery. The stumps of the trees are now left exposed and stand "crab-like" on the sand or shingle. The wind has cut the old dunes, largely heather-covered, into bizarre forms, but has enabled the tracing of the shingle ridges to be done far more easily than formerly. As will be shown later, these are all old dunes and, in places, the newer and bigger moving dunes are advancing on to them. The dunes marked J are normal fore-dunes formed some considerable time ago: they run north-westwards under the newer dunes.

In the area between A and A1 are some of the most interesting forms in the whole area. They are actually the same series as that described between A2 and Binsness, but they show a clearer development near A and A1. The area is a low one and crossed by several large shingle ridges. On its western

side it is gradually being overwhelmed by the oncoming of the big mobile dunes. A section through some of the better developed old dunes shows from top to bottom the following sequence:

1. Small masses of blown sand now closely turfed.
2. This passes downwards into a nearly black sand. The black colour is due to the decay of humus and represents an old surface. It is usually less than a foot thick.
3. Below this is indurated sand which appears to have accumulated under wind action.
4. At the bottom is the shingle, either the lows between ridges or a ridge proper.

It follows from (4) that the sand (3) varies in thickness a good deal. Sometimes two layers of black sand, usually best seen in the area marked A on the folding plate, may be seen separated by ordinary dune sand.

These patches now appear very much like small zeugen or buttes. They have been exposed by erosion. The old shingle surface of this part of the foreland was formerly covered with blown sand. From the few exposures visible this sand seems to have accumulated as a fairly level layer, but in all probability was an area of low dunes. On this sand vegetation grew and humus collected in the soil. Later, new sand was blown on to the area and new dunes, so far as can be seen of no great height, accumulated. These dunes were quite probably contemporaneous with the Culbin estate in historic times. The lowest sand appears to have followed closely on the raised-beach period.[1] It would however be difficult to say whether the 25-foot or 15-foot beach was involved. Later, probably after the destruction of the estate, erosion began to cut away the upper sand and in course of time gradually exposed the shingle ridges and has left these butte-like remains to-day. Unless the foresters arrest the big migrant hills in time, these buttes will once again be covered up. Between them and the relict dunes described above (*i.e.* south of A) there is a certain amount of modern blown sand, but it is possible to trace the general trend of the shingle ridges on either side of it.

Old dunes, some fairly high, are also found in the woods to the west of Binsness and Kincorth, but just to the north of the Binsness plantations modern dunes are invading the woodlands, and trees 30 to 40 feet high are often nearly covered. This is similar to what has happened in the Maviston dunes much farther west, where two major dune masses are now partly held by planting. But the larger is still advancing and has passed over a considerable area of old woodland.[2] The stumps of the trees stand out clearly and indicate the passage of the dunes. These are also the best examples of parabolic dunes to be found on Culbin.

Finally a word may be added about certain minor dune forms. On parts of big mobile dunes clumps of marram grass appear naturally or have been planted. These clumps collect sand and form small hillocks. After a period of winds from one direction long and beautifully formed tails of sand are to

[1] This old surface is a collecting ground for flints, etc.

[2] G. Bain, a careful local observer, stated that they have advanced nearly a mile during the present generation ('The river Findhorn from source to sea,' 1911, p. 241). See Ogilvie, *loc. cit.*, who also mapped them.

Cliff line of 25-foot beach, Cothill

Remains of Findhorn Hill Wood: wind erosion of tree stools

Inside the parabola of the major Maviston Dune, with the tree stumps over which the dunes have passed

Plantation of young trees on large dune. Typical flat, near Buckie Loch, in the foreground

be seen running down wind from them. Similar forms occasionally occur when the wind has blown through a low and narrow col in a line of dunes. Occasionally, when new sand is advancing on to an older dune mass, a well-marked ditch appears between the two and bends round the object to which the sand is advancing.

The origin of the Culbin Sands

This question has often been discussed and there is not much to add. It is clear to-day that sand accumulates on this shore, *e.g.* the large expanses bare at low water off Culbin, and particularly at Whiteness Head. W. Mackie [1] made analyses of the dune sand and gave the following as average composition: quartz 78 per cent.; felspar 18 per cent.; 1 per cent. composite fragments, probably quartz and felspar; 1 per cent. mica; 1 per cent. garnet; 1 per cent. magnetite, hornblende, tourmaline, zircon, or sphene. The average content of felspar in the sands of the Findhorn and Nairn rivers is about 24 per cent., and this is reduced to 18 per cent. in the Culbins. The felspars in the sands resemble those in the Ardclach and Kinsteary granites, and the quartz suggests a similar origin. Incidentally, Mackie notes that the Culbin Sands have the most rounded grains in the district.

We may conclude from this that a great deal of the sand is carried down by the Nairn and Findhorn rivers. This view is also locally maintained on quite general grounds, the Findhorn especially being liable to severe floods.[2] The direction of coastal drift on this coast is to the west, so that material brought down by these rivers, as well as that eroded from the coast to the east, will accumulate between Burghead and Inverness Firth.

Another source of supply is obtained in the glacial and post-glacial material which fringes the coast in great quantities. Much sand in the form of dunes had also gathered on the older raised beaches. Hence, there was, and is, no shortage of supply. A further factor which may be of importance has not, so far as I am aware, been noticed. The south shore of the Moray Firth runs east and west, and must act as a great groyne to any material travelling southwards along the sea floor from Caithness and Ross and Cromarty. A point such as this is hardly susceptible of proof, but in some ways it resembles what happens on the north Norfolk coast.

Once the flats had formed it is not difficult to see how the dunes would begin to develop (see Ogilvie, *loc. cit.*). The low-lying lands of Culbin would be an obvious place to accumulate sand unless matters were taken in hand in time. It is this which probably finally determined the destruction of the estate. The Act of Parliament of 1695 makes it quite clear that much sand had blown up to the west of the estate before the final inundation. Callander [3] also records that the Rev. J. McEwan of Dyke told him that there is no notice in the Kirk Session records of the calamity. This again suggests a gradual oncoming. In the absence of any definite records the following view seems the most reasonable. The sands of the west were increasing in amount. In

[1] *Trans. Edin. Geol. Soc.*, VII, 1899, p. 148.

[2] The river has also carried down much fertilizing silt which in past times helped to form the soils of Culbin. See also Sir T. Dick Lauder, 'An account of the great floods of August 1829 in the province of Moray . . .,' 1830, and 3rd ed. 1873, Elgin.

[3] *Proc. Soc. Ant. Scotland*, XLV, p. 158—an important point.

storms it is likely that a thin layer was occasionally added to some of the fields. At first this would not cause much comment, but in the years preceding 1695 there were violent storms and quantities of sand were carried eastwards. Records of the parishes of Kinloss and Alves also testify to this. At this time, then, we may certainly assume that a great deal of sand was blown on to the estate which was clearly in financial difficulties. Once a layer sufficiently thick to make agricultural operations of no avail had gathered, the rest was only a matter of time. I do not know when the Culbin House was finally evacuated, but it would follow soon after this devastation. It is now buried under one of the big dunes—tradition has it under the first big one as one goes into the sands by the path at the cottages east of Kincorth House, but traces found a few years ago suggest that it stood in a hollow to the north-west of this dune.[1] The house did reappear on one occasion about the end of the eighteenth century, and many of the stones were removed and used in local buildings. An elderberry tree is still growing in the sands just west of the area A (folding plate): it is near two rigs of old soil and may conceivably be a survivor. It was a common practice in this part of Scotland to plant these trees next to habitations. A large number of relics of the estate have been found from time to time and it is clear that, whatever the precise nature of the inundation, it was sufficiently effective to preclude the salving of all the farming implements. It may also be pertinent to note that in the Parish of Dyke and Moy (in which Culbin lies) there were several sand storms that did much damage about the beginning of the thirteenth century.[2] The less intensive methods of agriculture in 1695 would probably have succumbed quicker than would those of to-day.

The shingle ridges of the Culbin foreland

These ridges and other features were carefully mapped by plane-tabling. The ridges are frequently covered by massive dunes, and, as at E and D (folding plate) where extensive shingle ridges are found, they are now planted and the conifers are 10 or 12 feet high. Hence the mapping is not easy, but careful attention was given to the trend of the ridges, and the map may be taken as correct in this respect. It is almost impossible to indicate the true number of the ridges not only in places such as D, E, and F, but also at A,[3] either because the trees make counting of individual ridges very difficult and the tracing of each one separately almost an impossibility, or (and this applies more particularly to A) because the ridges are still largely sand covered, and one can only obtain a general idea of their trend and number. It is also easy in this area to be misled by appearances. Often a ridge shows up in the hollows of the hills but on further inspection turns out to be mainly a sand ridge with shingle on top of it.[4] There is also much raised shingle in the area I, but it is not possible to make out any definite trend lines.

[1] Some foundations of a large house were found here. It is more than likely that most of the smaller houses on the old estate were of wood and mud. No traces are likely to be found of them. Chimneys of a big house are also said to have appeared on one occasion, but it is not known where.

[2] 'The new statistical account of Scotland,' XIII, 1845.

[3] In most parts of the fan the number of ridges is greater than shown on the map.

[4] The ridges C1 and those north of A1 (in the area A1) are of this nature.

All the ridges A to I inclusive are raised beaches, but it is not possible to say if they belong to the 25- or 15-foot stages. Tentatively I am of the opinion that they may indicate both stages, assuming that there was not a rapid fall of the sea between them. A ridge can often be thrown up to a considerable height above mean sea-level, and, even if detailed levelling were practicable, I doubt if any conclusive results would be obtained.

As it is not possible to map the whole of the ridges because of blown sand, one must draw conclusions from their general trends as seen on the map. It is not, I think, misleading to assume that the general disposition of the ridges F, G, C, B, A1, indicates a long curving series with groups of re-curved ends at, *e.g.*, D and E. There is no doubt that the western fan is the true end of the system. But at A matters are more complicated. At A and A2 high and well-developed ridges run into Findhorn Bay and are clearly eroded. There is no doubt that they once continued farther in an approximately south-easterly direction. The ridges on the eastern side of Findhorn Bay, south of the harbour of Findhorn, run to the south of west. Allowing for the fact that the Findhorn has certainly changed its course, there does not seem to be any necessary connection between the earlier ridges on either side of Findhorn Bay.[1]

On the other hand this does not negative the idea that at one time there may have been overlapping ridges from west and east in Findhorn Bay, and that the river found its way between them. The field evidence however definitely suggests two original and independent systems east and west of the Bay.

It is then important to account for the western system which, on this view, could not have sprung from any headland. In the first place, obviously plenty of material was available for ridge formation. This we may assume was partly supplied by the Findhorn and partly by the glacial and other deposits along the shore. An inspection of the map makes it clear that the massive ridge G (which is really a composite one) is later than the ridges D, E, and F, but it is now quite out of the question to say which of the ridges in A1 and A correspond to it. The ridge in A1, indicated by an arrow, may do so, but this is merely based on the fact that it is a major one. However, leaving this point aside, it is evident that in A and A1 we have evidence of a prograding shoreline. Every succeeding ridge to the north-east is newer than its south-western neighbour. At the other end of the complex group F is newer than group E, and E newer than D; and the same general argument applies to the individual ridges of any series.

It is clear that when the group D was formed the curve of the whole system must have been greater than now. How the curve ran is problematical, but possibly south-east of H. This curve was flattened and gave rise to the laterals at E, and further evolution gave the series F. G1 seems to be merely a local attachment to the F group. During much of this time the group A may have been extending north-eastwards. The small exposure at B suggests on the ground that if the dunes were cleared away newer ridges to the north of the group would be found. In short, the evolution of the whole series can be illustrated diagrammatically as in Fig. 3. Such a scheme is by no means

[1] See A. G. Ogilvie, *loc. cit.*, who suggested a connection across the bay.

unusual though perhaps on rather a bigger scale than is commonly found. It implies that all the ridges are really off-shore bars, and that they were not at any time tied to a headland. We may presume that the direction of beach-drift was then, as now, mainly to the west and south-west. We may also probably assume that shingle could travel across Findhorn Bay. The disposition of the ridges definitely indicates a more pronounced curve in earlier times. This would form a shingle headland, and would also form a focus of wave attack. On the normal beach-drifting view the headland would be cut back and material would travel to the south-west and in course of time build up the vast fan that can now be traced on the ground.

A difficulty may however be found in the progradation which has taken place at A and A1. The arrangement of these ridges, so far as they can be seen, makes it quite clear that there is no fan here as at the western end, but that each ridge is roughly parallel to any other and consequently the series

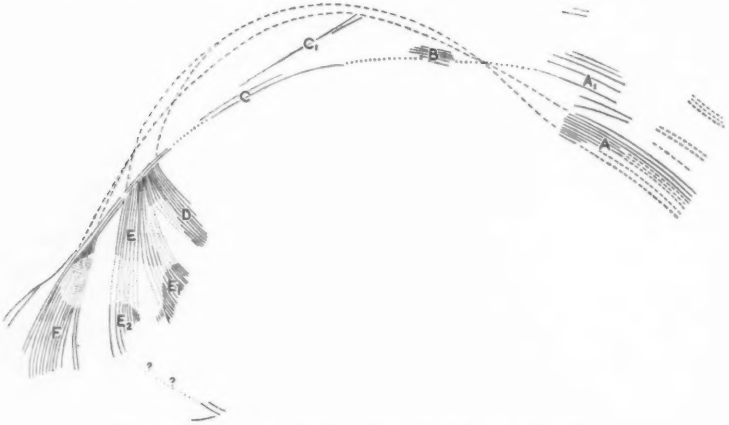


Fig. 3. Probable evolution of the Culbin shingle ridges

has grown out to the north-east. There is to-day clear evidence that material comes from the eastward, and if that were the case in earlier times this north-easterly facing part of the complex would always be receiving new material and its off-shore zone would shallow and give conditions suitable for the formation of new ridges. Hence a fan at the western end, cutting back in the mid-parts, and forward growth at the eastern end, are by no means antagonistic tendencies. Further, as a result of the south-easterly trend of these beaches, winds from any direction between west and north-north-east would produce a strong tendency for beach material on this eastern area to move south-eastwards.

On a far smaller scale the example finds a rough parallel at Thornham in Norfolk. In the *Geogr. J.* 87 (1936) 35–46, the formation of a small sand-shell-and-shingle island was described which has much the same general orientation as had the Culbin system. At Thornham growth goes on at either

end and the middle part is washed back. In some ways the general structure of the ridges and dunes immediately east of Wells Harbour, also in Norfolk, shows similar features.[1]

One point arises: did this shingle fan ever deflect the river Findhorn to the west? In the absence of systematic boring it is doubtful if any definite answer can be given to this question. The fact that the A ridges are severely truncated may suggest that they were attacked by the river (or sea) in one of its changes of course, and that at an earlier time the river flowed south of the whole fan. At the present time there are several low-lying damp hollows south of the shingle ridges which may indicate part of the former course. But this view is purely hypothetical. For the same reason the old course, as shown on Craig's map,[2] can only be regarded as a rough guess. There is nothing inherently improbable in the growth of a great shingle fan on a sand-and-shingle flat in the manner described, and there is no need to assume it deflected the river.

The ridges to the north of G1, G, C, ?C1, B, and A, seem definitely to belong to a later and lower system. They could probably all have been formed at present sea-level, and I think they make a definite link with historical changes in the course of the river Findhorn.

It should also be mentioned that the small patches of shingle, definitely parts of ridges, near ?F or E2, and to the north and north-east of these positions, are probably parts of the long re-curves of the F, E2, and E1 series. It cannot be said precisely how they link up as the area is wooded and dune covered. It is also extremely difficult to map the exact positions of the exposures because it is impossible to obtain sights for resecting. But the positions of these odd patches as indicated on the folding map are relatively correct. The ridges suggested at J are dune ridges and probably rest on shingle. They seem to be a newer set than A and A1, and give the impression of having been formed at a comparatively late time by north-easterly waves in Findhorn Bay before it was so enclosed as it is now. They have been inserted on the map because the lines of dunes are so clear.

Before concluding this section two or three other matters may be mentioned. It has been said that Culbin was once a flourishing agricultural estate. The continued ploughing of the land resulted in rigs being formed. As the soil was stony, these rigs often appear as flat shingle ridges and are at first a trifle deceptive. A moment's investigation with a stick will soon show that a soil exists and that they are cultivation features. Occasionally a high and isolated shingle mound is found. There is one marked on the map. This mound may be artificial, or even possibly part of a former dune ridge, which has been at an earlier time covered with stones. The stones have protected it from the wind, and it now stands out conspicuously from its surroundings. Pirie [3] described a somewhat similar mound in the north-eastern part of Culbin as follows: "There are a few yards of grassy ground on the top. The soil on the top is black, and from nine inches to twenty-one

[1] See *Trans. Norfolk and Norwich Nat. Soc.*, XIV, 1937 (published 1938).

[2] *Trans. Edin. Geol. Soc.*, V, 1888. See also J. B. Murdoch, *Trans. Geol. Soc. Glasgow*, IX, 1888–92.

[3] *Elgin Courant*, 22 July 1884.

inches deep. This black mould is fixed with small stones and below is sand. The grassy top is level and appears to be the remains of a more extensive grassy covering. The sides of the mound are covered with small water-worn stones, mostly broken like road metal. This mound appears to have been artificially raised, but for what purpose does not seem very certain." I agree with Pirie and think the mound marked is possibly artificial, but it is not now turfed.

The pebbles of many of the beaches reveal the action of the sand-blast most effectively. A granite pebble, for example, shows that the wind has etched out the softer felspars and mica, and left the harder quartz standing out in relief. Sandstone pebbles traversed by harder veins show the veins in relief. Similar effects are seen with other types of pebble.

Burghead Bay

The Culbin foreland must be considered in relation to the parts of the coast on either side of it, more especially to Burghead Bay and its series of raised ridges. The great sweep of this bay is bordered along its whole length by raised shingle ridges belonging to the 25- and 15-foot stages. These are often dune covered, but of recent years much sand has been blown away from the western end, and so exposed the trend and numbers of the ridges more clearly. This has made their mapping, undertaken by Mr. Balchin, an easier process. His map (see folding plate) is a very careful plane-table survey, and may be relied upon in detail. The sand blown from the western end accumulates nearer Burghead and, though the ridges there are usually obscured, some of the important trends are still visible.

Inside the shingle ridges are extensive areas of carse and flat-lying shingle spreads. These have in part been taken over by the Forestry Commissioners and are either already planted or ploughed in preparation for planting. At Findhorn itself a golf course and the town obscure the ridges, but a study of the ground and map makes it quite clear that the general trend of the ridges continues uninterruptedly. All the ridges at their western extremities show a decided curve to the south-west and this, considered with the marked south-eastern trend of the easternmost Culbin ridges, implies that there was never a connection between the two systems across the bay.

Roughly the whole western half of the foreshore has suffered erosion in recent years: near Findhorn for example a strip about 200 feet wide has been taken from the foreshore since 1904. Nearer Burghead erosion has ceased and is occasionally replaced by aggradation, as can be seen in the slope of the dunes and new sand formations[1]. The amount is small and barely shows on the 6-inch scale.

The whole mass of ridges falls really into three major groups with perhaps a few sub-groups. The oldest series is marked A on the map. It consists of a number of ridges running to the south-west, and near Muirhead they cross the Forres–Burghead road. These ridges are entirely distinct from any newer group and it is difficult to relate them to various remnants nearer Burghead.

[1] Drift-line plants, *Salsola kali* and *Cakile maritima*, are often locally abundant on this part of the foreshore.

I agree generally with Ogilvie[1] in suggesting a tentative age correlation, but not necessarily connection, with the high masses of shingle under Rose Valley Wood, though such a possibility must be treated with caution.

Near Burghead the ridges marked H1 and H2 are very high and massive. They may be high storm beaches of the 25-foot sea, or even of a sea at a higher level. But it is almost impossible to relate the true height of a former sea to one or two isolated ridges.

At the time the A ridges were being built Findhorn Bay would have had a very much wider mouth and the sea would have come up into what is now the valley of Kinloss Burn. In former and higher sea-levels (see Ogilvie, *loc. cit.*) Roseisle would have been an island, but at the time with which we are dealing, the eastern entrance would have been closed, and alluviation would be going on within the ridges. It is therefore quite possible that group A constitutes part of a series of ridges formed as spits running from the higher ground of Roseisle and Hempriggs, but now much broken by subsequent erosion, so that only traces remain.

The next episode seems to have been the formation of the ridges, whose ends alone remain, at B. These are probably to be correlated in part with B1, and it is clear that erosion in early times in Burghead Bay cut away their middle parts. This episode was followed by the building of the great series marked C. These extend much farther west and show the typical branching form and re-curved ends very well indeed. Although it is clear that their north-eastern ends are truncated, this in itself does not imply that they were necessarily once continuous with, *e.g.* the Burghead promontory. The erosion of the B ridges must have been largely responsible for supplying the material of which the C ridges are built. The ridge marked Cn appears to have been the last of this series, and on the ground makes a definite boundary, and may even indicate a change of level between the C and D ridges.

The D ridges show generally similar features: they are continuous and well developed. Their north-eastern ends are cut off by the present coast, and again one may suggest that much of the material of which they are built came from the eroded north-eastern ends of the C ridges. It may here be remarked that, whilst erosion of the B group has helped in the building of the C group, and the erosion of the C group has supplied some of the material for the formation of the D group, the same argument also applies to individual ridges in each series.

The Findhorn (*i.e.* Culbin Sands) Hotel stands on the outermost and most recent of the D ridges. Then follows the modern series E, all formed at present sea-level. As described below, the modern ridges were at one time far longer and continued into the Old Bar. When this was cut through new growth occurred, and the present ridges formed, although some of their inner members may well have formed a good deal earlier.

The evolution as outlined here does not necessarily imply a vast amount of erosion in Burghead Bay. Wallace [2] and others speak of people only a few centuries ago being able to walk nearly in a "right line" from Findhorn to Burghead, part of this distance lying across a submerged forest. But, whilst

[1] *Loc. cit.*

[2] See, *e.g. Trans. Inverness Sci. Soc. and Field Club*, V, 1895–99.

obviously acknowledging that much erosion has gone on along the shores of the bay, I think that any suggestion of a direct path, even at low water, between Findhorn and Burghead is pure imagination.[1] Taken literally, it would imply that about $2\frac{1}{2}$ miles had disappeared in the middle part of the Bay. An analysis, and careful mapping, of the ground shows that such an assumption is improbable. On the other hand, erosion has certainly taken place and we may have no doubt that there was a regular "road" seaward of the present high-water mark between Findhorn and Burghead; neither need we doubt that in the past a rough walking track led over part of a formerly visible submerged forest. Such an assumption need not imply a vast amount of erosion. The blowing away of formerly high dunes near Findhorn would also give rise to exaggerated notions of change. It is known, for example, that the Douff-Hillock [2] has disappeared. If this were artificial and probably partly of blown sand, marine and aeolian erosion would readily account for its disappearance.

Before summarizing diagrammatically the probable evolution of the Burghead Bay ridges, attention must be called to those marked X1, X2, and X3. These are the most puzzling of all. They are not re-curved ends of, *e.g.* group C. They certainly extended at one time much farther westward, but one cannot say how far. It may even be suggested that they are related to the series A1, B, and C, of the Culbin ridges. Whatever their former nature they are clearly unrelated to any other of the Burghead Bay groups. What is left of them suggests that they were once of the nature of off-shore bars formed subsequently to the A group of Burghead Bay. At this early time we do not know the precise course of the lower Findhorn. Sea-level was then 15 feet or more higher than now, and it is not a far-fetched hypothesis to suggest that the river then ran inside these ridges and had its mouth north of Hatton Farm, or, and this is in greater conformity with known changes, that the X bars caused a westward deflection and that the river then flowed inside the great Culbin fan. All this is purely hypothetical, but with changing sea-level and rapidly developing ridges such changes are far from impossible, though not now susceptible of proof. The group Y is also apparently aberrant. It hardly conforms to group C, and is clearly older than that group. The trend of group Y is not entirely inconsistent with the idea of a former connection between Y and X3. Finally, it should be noted that there is much shingle in the fields of the various farms. Agricultural operations have made it quite impossible to map this or to see any ridge pattern in it, but if such changes had not occurred it might make the relation of the X and Y bars clearer.

The general evolution of the various series of ridges can be seen in Fig. 3. As the dominant wave direction in Burghead Bay changes from almost due west just to the south of Burghead to about north-east near Findhorn, the

[1] For further details, see paper by Wallace, *loc. cit.* He speaks of erosion near the Bessie Burn. It is more than probable that erosion and progradation have been intermittent along parts of Burghead Bay, but erosion has been much more effective throughout.

[2] According to Grant and Leslie, 'A survey of the province of Moray,' 1798, this was "artificial."

whole development appears to throw interesting light on Lewis's [1] theory of ridge and bar formation.

The river Findhorn and The Bar

The recent history of the Culbin foreland and Burghead Bay is intimately related to the changes in the mouth of the Findhorn. No early maps and charts are known, but a good deal of light is thrown upon the problem by two surveys. In June, 1758, Peter May made a careful survey of the area in connection with a dispute concerning fishing rights in Findhorn,[2] and his map (see folding map) shows quite clearly the old course of the river. Referred to a modern map, the "Mouth of the old Barr of Findhorn" is situated about a mile westwards from the eastern end of what is now called The Bar. I am unable to state when this was the actual mouth of the river or to date the mouth marked "Breach" (about $1\frac{1}{4}$ miles west of the Shelly Hillock) on May's map. It may never have been more than a temporary mouth.

The river then ran by way of the pricked lines shown on May's chart. We may take this chart as accurate in so far as ordinary detail is concerned. It makes it clear that Buckie Loch was part of the old course, and the marshy areas near that loch are all consistent with this conclusion. The subsequent history of the Old Bar of May's map is discussed below, but part of it at least seems to have stayed *in situ* and the old channel gradually silted up and/or was filled with blown sand. In other words, this part of the Culbin foreshore received a considerable addition of territory. Some of the newest ridges in our own survey seem to belong to this episode.

The old town of Findhorn stood about 1 mile to the north-west of the present town (see May's chart). On 11 October 1702, during a severe storm, another breach was made and the river formed its present mouth. The inhabitants of the town had foreseen this event,[3] and although it meant that within a few years of 1702 the old town was destroyed, the catastrophe was not so serious as might be imagined. Since 1702 the mouth has fluctuated a little and the bar at the mouth now, as then, always has a tendency to push westward. There seems to be some confusion about the earlier Findhorns. There is no doubt at all that the earlier town lay about 1 mile to the west of the present town, but several writers seem to imply a still earlier town which stood at the mouth of the river when it was farthest west.[4] Dunbar in 'Documents,' p. 81, quotes: "That the said town and lands of Findhorn, burgh of Barony of the same, was upon the North side of the old course of the river, four or five miles from the mouth thereof, in which course, *within lands*, the ships and boats were navigate to the said old town of Findhorn." This is definite, and clearly implies that there was not a town at the mouth, and Murray (*loc. cit.*) makes no mention of the supposed "first" town. From

[1] *Geogr. J.* 78 (1931) 129.

[2] The original is in the Register House, Edinburgh. Other copies on a smaller scale and differing in unessential details for the present purpose are not uncommon. The map on the folding plate was based on a copy in the Signet Library, and on a copy from Altyre House.

[3] 'Old Findhorn,' J. G. Murray, no date.

[4] *E.g.* T. Wallace, *Trans. Inverness Sci. Soc. and Field Club*, II, 1880–83, and *Trans. Edin. Geol. Soc.*, IV, 1883.

a careful consideration of the available and meagre evidence, I am of the opinion that it did not exist.[1] In passing it may be remarked that Findhorn, formerly a thriving port, now is but a small fishing harbour and a seaside resort.

The survey of 1730 [2] generally bears out these conclusions. The scale is smaller than that used for May's map and the river mouth is more generalized. But if the dry land only is considered it suggests that the mouth was approximately where May showed it after 1702. On the other hand, no mention is made of the "Breach." The outline of the Old Bar is shown as a long spit. As suggested above, we may assume the part between this and Culbin gradually silted up. Legally the point is interesting. The Court of Session case of 1758 implies that a part of the Muirtown estate, *i.e.* east and north of the river, was added to the Culbin estate, and the change in the course of the river led to the obliteration of the fishing stells which was the immediate cause of the litigation.

But the 1730 map, which bears every evidence of being a careful survey, makes no reference whatever to the present Bar. This may be deliberate, but when all the detail is considered, it is difficult to avoid the conclusion that The Bar as we now know it did not exist, or that it was in such a primitive state that it was thought not worth while to show it. We know from Admiralty surveys published in 1835 that The Bar was then a pronounced feature, about five-sixths of a mile shorter than, but of much the same shape as, it is to-day. The many papers written about the Culbin Sands usually make some reference, never illustrated by any map, to The Bar.[3] The usual reference seems to imply that the river once had its mouth at the Old Bar, and one is left with the impression that the writer may refer to The Bar as seen to-day. But taking May's map as sufficiently accurate for our purpose, it is quite clear that the earliest known mouth of the Findhorn was never more than about 1 mile west from the present eastern end of the modern Bar (see folding plate).

The Bar as it exists at present is an interesting structure. The northern half is formed almost entirely of sand. On much of this part there has been recent growth on the seaward side since, along considerable parts, two newer and lower dune ridges have been added to the innermost and highest ridge. There is some shingle at the northern end and also along the inner side of the northern part of The Bar. It is probable that the dunes rest on a ridge of shingle. Near the mid parts of The Bar, three or four old re-curves occur. These are built of shingle and are widely spaced, and they occasionally curve right back on their original direction. South of this again, The Bar is very narrow and formed of a long low ridge or ridges of sand with possibly some

[1] It is extremely unlikely that a town would be built at the end of a long narrow bar. There is no evidence that a town existed on the Culbin side of the river. It is possible that a few fishermen's huts were standing at the end of the bar, but these would not constitute a "town."

[2] The map was made between 1725 and 1730 by John Avery for "The Honble. Coll. Horsey Governor and Directors of the York Building Company." As far as is known no copy of this map exists, or has been reproduced, other than the original in the Burgh and County Library, Inverness. I am indebted to Mr. Peters, the Librarian, for this information.

[3] See T. Wallace, *loc. cit.*

Large blow-out forming along the trend of a dune ridge on the north shore of the Culbins

Dunes advancing on woodland, Maviston

Butte dunes, Culbin

Butte dune, showing blown (top), black, and (below) indurated sand

shingle which appear to have been overrun in fairly recent storms.[1] Immediately to the south of this, the whole appearance alters, and The Bar becomes a magnificent shingle foreland with sometimes about eighteen ridges running nearly parallel to one another. The inner ridges are covered thickly with vegetation, large masses of gorse, heather, and crowberry growing luxuriantly. Low dunes also occur, but hardly as continuous ridges. The newer ridges are usually quite bare.

The inner side of this part of The Bar shows an excellent series of re-curves enclosing narrow marshes, now frequently covered with a growth of *Suaeda maritima* and *Salicornia* spp. Other marsh plants, especially *Glyceria*, occur, but in far less numbers. Often these re-curves are diversified by minor hooks. The ridges on the seaward side are obliquely truncated at their northern ends, but run southward and terminate in modern re-curves. The southern extremity of The Bar resembles other similar shingle structures. It shows every sign of continuous growth: new and small shingle ridges of the usual re-curved form can be seen, and dunes are forming on them.[2] South of these a long sand-flat occurs which is awash at high water.

The point which calls for an explanation is the presence of shingle in the southern half and its almost complete absence in the northern half. The truncation of the shingle ridges at their northern ends clearly implies their former greater extent in that direction, and also that the shingle is swept away from their northern ends and piled up farther south. If, as is quite reasonable, we assume this to have gone on in the past, we see why the shingle is now only found to the south (see Fig. 4). In this way it is possible, in fact probable, that the present Bar is a direct descendant of the Old Bar.

It is however curious that the dune ridge remains in the north. Although there is very little shingle visible, it is by no means unlikely that the dunes rest on a ridge. At present the sea is mainly attacking the central part of The Bar. The precise reason for this cannot be given. But in spite of this fact the northern end remains stable, and new dune ridges are added by wind action working over the extensive sand-flats alongside The Bar. The whole structure clearly indicates a southern travel and remoulding of the shingle into ridges at the southern end. The growth of The Bar since 1835 (Admiralty survey) is almost five-sixths of a mile. Assuming this rate to have been approximately constant, it means that the old mouth as shown on May's chart was available about three and a half centuries ago. This is a very rough estimate because the growth cannot have been regular, and erosion may often have cut off parts of The Bar. Nevertheless, the measurements and assumptions are in reasonable accord with the historical and physiographical evidence.

If the marsh had not grown so much inside the middle part of The Bar it is possible that it might now be severed ; as it is, the stability given by the marsh has preserved it as a unit, but has not prevented the sea from washing over its lowest parts.

On these assumptions, the difficulty of relating the present and the Old Bar is overcome to some extent. In past times, as now, there were probably

[1] The survey made by Mr. W. G. V. Balchin in 1937 shows that this part of The Bar has suffered considerable erosion.

[2] Since 1904 the growth has been about one-third of a mile.

extensive sand-flats and much shallow water off Culbin. The original bar was almost certainly formed of shingle, and when the mouth of the Findhorn formed in 1702, part of The Bar became attached to Culbin. But along its own foreshore shingle would still move westwards, and probably a good deal had already crossed the old mouth and accumulated on its western side. This is similar to what is known to have happened at Orford Ness and Shingle Street.[1] Some of this shingle may have been driven back to the main Culbin for shore, and a few ridges and coastal spread to be seen there to-day were probably formed in this way.[2] They certainly could not form under present conditions. On the sand-flats however which were probably uncovered at high water shingle ridges, derived from the material of the Old Bar, would naturally be

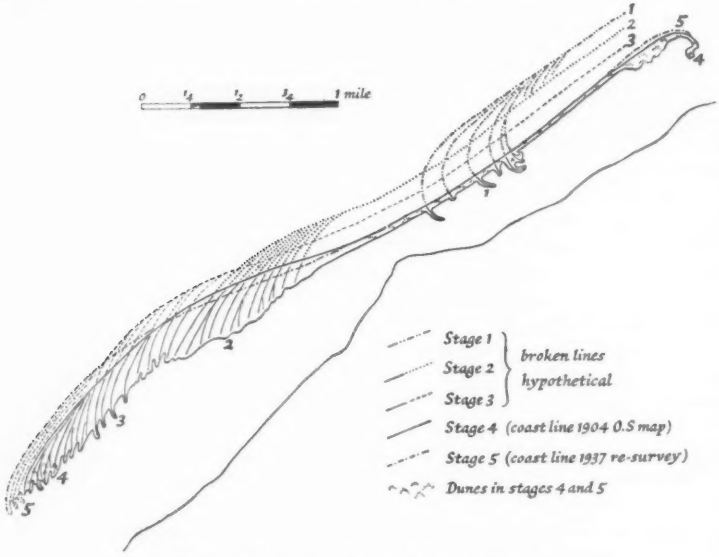


Fig. 4. Stages in the evolution of The Bar

built by wave action. At the same time the tendency, so marked on this coast, for material to move west and south-west asserted itself. If then we presume an initial mass of ridges, formed as suggested above, close to and west of the Old Bar, we may also assume that that same shingle gradually shifted southwards in the manner described in the present bar to-day.[3]

This explanation more easily accounts for the lack of shingle between that at the southern end of the present bar and the north-eastern part of Culbin, for the difficulty of assuming a completely new structure, *i.e.* that the present

[1] *Proc. Geol. Assoc.*, vol. 27, 1926, p. 306.

[2] This shingle occurs opposite The Island and northern end of The Bar.

[3] Shingle would also presumably move westwards from that part of the Old Bar which became attached to Culbin: the small amount there to-day suggests this.

bar grew *in situ*, and for the assertion generally made that the Findhorn once flowed out from behind The Bar, but, on this view, when it had reached only as far as shown on May's map.

There are however difficulties. The Island, an artificially protected dune resting on a mass of coarse shingle, is one. It was possibly part of the Old Bar but there is no apparent reason why it should have remained where it is. Again a comparison with Orford Ness may not be irrelevant. Between the distal end of that shingle bar and the mainland south of it, shingle knolls often form. At Orford however there is relatively deep water. If a similar knoll were to form west of Culbin greater stability is likely on account of the much shallower water. Precise evidence for the formation of The Island however is lacking.

The known rate of growth of The Bar in recent years is in fair agreement with the explanation suggested above. But these difficulties are less than those inherent in other hypotheses. The 1730 map is not quite consistent with this view, but it must be remembered that a shingle bar would not be very conspicuous, and the surveyor would not necessarily consider it unless it were an area of dry land. To put the matter the other way round: how much of the present bar would be thought worthy to appear on a topographical map if all the dunes and marsh (which buttresses it) were removed?

The present westward extension of the sand spit north-west of Buckie Loch, and the decay of the presumed former settlement of Maviston are both entirely consistent with the hypothesis outlined above.

Auldearn to Nairn

The western end of the area we have taken as the Culbin foreland is at Nairn, where Old Red Sandstone rocks outcrop on the foreshore. It is, then, relevant to consider that part of the coast between Nairn and Culbin. It consists wholly of a sandy carse-like area faced by low fore-dunes and extensive sand-flats and backed by the cliff of the 25-foot episode. This cliff is remarkably well developed from Kintessack to Nairn. It is steep and still fresh in appearance. Often it is fringed by damp or marshy ground, as happens just east of Cothill. There is nothing to suggest a halt at 15 feet along this part of the coast. Most of the area is under woodland and natural sections are few except in ditches. Many traverses through the area have revealed nothing but sand, and the whole stretch may be regarded as a raised sand-flat, not entirely level as is evidenced by Loch Loy and Cran Loch and other minor pools.[1]

The quarries at Kingsteps show that the Old Red Sandstone occurs underneath the sand, and the small and disused quarry on the north side of the road illustrates the relations of the eastern Nairn Golf Links to the underlying rocks. Occasional thin peaty layers are seen in this quarry indicating marshy conditions such as occur to-day. If the present Nairn foreshore were uplifted we should have an almost exact replica of the conditions shown in this section. The higher quarries to the north of the road show boulder clay resting on

[1] These lochs, which are fresh, presumably originated in hollows, later intensified by dune growth, in coastal sand-flats. The phenomenon is a common one on low coasts.

solid rock and capped by sands and one or two peat layers. The sands are certainly aeolian and may belong to the 25-foot episode. In one place a depression in the boulder clay is filled with sand and occasional lenticles of shingle. It probably represents a small gulley filled with landwash and beach material.

Nairn harbour marks an important point in the coast-line. Immediately east of it for 200–300 yards erosion is going on, which is ascribed partly to the growth of The Bar and partly to the harbour piers.[1] The water has deepened here of quite recent years, and bigger waves work upon the shingle. East of this stretch the shingle and dunes are prograding. This part is characterized by a marked growth of *Elymus arenarius*. Erosion a few years ago was serious west of the harbour, but the new groynes have helped. Each groyne in turn, starting from that nearest the harbour, has collected material, and by a judicious selection of height and length these groynes have accumulated material on their eastern sides to the greatest advantage. Erosion is now confined to the central parts only of the Nairn foreshore, but is not very serious. Aggradation begins again some little way on the town side of the club house of Nairn (western) Golf Links, but this paper is not concerned with local details west of Nairn.

The salt marshes

The final episode in the development of the present coastal forms has been the formation of salt marshes within The Bar and in Findhorn Bay.

The River Findhorn has built a delta in the bay which, except for the actual channels of the Muckle Burn, Mosset Burn, Findhorn, and Kinloss Burn, is shallow over most of its area. This silting process continues, and there is a mixture of salt and fresh water marsh at the landward end of the bay. Saltings also occur round its margins and are well developed inside Culbin and south of Findhorn.

The marshes within The Bar are perhaps of greater interest to the coastal physiographer. Near Buckie Loch and other parts of the Culbin foreland, they sometimes merge with brackish- or fresh-water marsh, but they are mainly salt marshes. Their general position is like those of the Norfolk coast, enclosed within a bar. There are however many differences in detail. The absence of *Obione* and the various *Statices* gives them a distinctly different appearance, and also a less colourful one. Creeks are present but are not deep, and by no means so fully developed as in Norfolk. Many of these creeks show much secondary marsh growing within them, and in parts of their courses minor creeks are almost obliterated.

The main characteristic is the extremely sandy nature of the marsh. This is hardly surprising, but it is rare to find even 6 inches of silt (see map of The Bar), and even then it contains a good deal of blown sand. The tidal range is 11 to 13 feet at springs, which is rather small compared with that on the

[1] I am indebted to the Harbourmaster of Nairn for much of the information on this matter. Further details, prior to 1911, are given in 'The Royal Commission on Coast Erosion and Afforestation,' vol. ii, 1911, Minutes of Evidence 25144 *et seq.*: and see index, pp. 274 and 275. Other interesting information, bearing indirectly on this paper, on the harbours of Nairn, Burghead, and Findhorn will be found in 'Tidal Harbours Commission,' Appendix (C) to Second Report, London, 1847, pp. 338–45.

Norfolk coast.[1] The central parts of the marsh area are covered only by big tides, but they spread over the whole distance between The Bar and the mainland. Salt pans occur, but they are not particularly prominent. They are mostly normal primary pans, but, like the creeks, are frequently covered by later vegetation, so that they often only appear as very shallow depressions, sometimes of a rather darker green than the rest of the marsh around them. Channel pans are common, and occasionally growth has extended across them leaving but a series of small holes. In this way they closely resemble the Dovey marshes in Wales.

The main colonizer is *Glyceria maritima*. This grass dominates the marshes and often gives them a lawn-like appearance. It is not always the first plant to appear, but over large stretches between Nairn and Maviston dunes, and again near Buckie Loch, it is spreading in mats and clumps, at present disconnected, over the sand-flats. In course of time these clumps close up and give a continuous covering.

In a few places *Zostera* follows directly on the Algal zone, but it is not common.

The sward consists usually of a base of *Glyceria* with the following plants: *Glaux maritima; Armeria maritima; Plantago* spp.; *Spergularia media; Aster tripolium; Triglochin maritimum*. The newer marshes, especially those within the laterals of The Bar, contain abundant *Salicornia* spp. and *Suaeda maritima*. Here, and elsewhere, these plants frequently grow in a thick algal mat which is present over much of the saltings. *Juncus* spp. are common at higher levels and in transition areas to brackish and fresh marsh. *Triglochin* often characteristically fringes parts of the creeks, and in this way, but to a much smaller extent, resembles *Obione* on the Norfolk marshes.

The drift-lines are frequently marked by species of *Atriplex; Salsola kali* and *Cakile maritima* are not uncommon on the more exposed drift-lines.

The marsh area is rapidly extending and the level gradually rising. Although no measurements of the upward rate of growth of the marshes are available, I am strongly of the opinion that blown sand is a factor of far greater importance than silt.

Without doubt the growth of these marshes has greatly strengthened The Bar which, in its middle part, would have been severed had they not been present. If matters continue in their present state, it will not be long, in terms of physiographical time, before there is a complete carpet of marsh broken by but a few creeks between The Bar and the mainland.

Conclusion

The mapping of the shingle ridges on either side of Findhorn Bay has shown their disposition and trends clearly (see Fig. 1). Their separate evolution has been described. This may be open to other interpretations, especially on the Culbin side where so much is hidden. On the other hand, it is extremely difficult to relate events on either side of the Bay.

[1] Neap range at Nairn is 8 to 11 feet, f. and c. 11.45 a.m. The tides at Findhorn are about the same as at Nairn, but H.W. is 15 minutes later. Good tides are associated with winds between north-west and south; poor tides with wind north to east. Information from the Harbourmaster, Nairn.

The first stage, during the retreat of the sea from the 25-foot cliff, was almost certainly a shallowing, not only of the area of the present bay of Findhorn but also of the whole stretch of shore here discussed. Rose Valley and Hempriggs ridges would have become incorporated in the mainland. Before this the H and H1 ridges may have formed from Burghead. Later, the A ridges of Burghead Bay were built. These were followed by B, C, D, and E, in that order. The X and Y ridges are a difficulty. They do not conform to the general scheme of evolution of the other groups. Suggestions to account for them have been made above, but the X ridges, if not the Y ridges as well, strongly suggest that they are of the nature of off-shore bars formed after the A group and possibly before, or contemporaneously with, the B group. They are in any case earlier than group C.

It cannot be said when the Culbin ridges were formed in relation to the Burghead Bay ridges. On quite general grounds I incline to place the formation and evolution (which probably took some considerable time) of the main Culbin ridges as approximately contemporaneous with the C and D groups of Burghead Bay.[1] They occupy roughly corresponding positions, and it is reasonable to suppose that they are later than the A ridges of Burghead because the trend of those ridges suggests a wider bay with the material moving more to the south-west. Also the Culbin area may be presumed to have had less shingle of its own than was the case east of the bay. Whether the river ran inside the Culbin fan remains uncertain. If it did, or if it did not, it is clear that shingle has crossed the bay and has been built into ridges. As the Culbin ridges are numerous and massive, it seems likely that, as the amount of shingle was large, the *beginning* of the evolution of the Culbin fan followed the A and possibly also the X and Y episodes east of the bay but preceded all later stages. As noted above, the field evidence seems definitely against any connection across the bay between the Culbin and Burghead ridges at this time.

The final stages of the evolution are clearer. Historical evidence shows us that the E group of Findhorn once formed a long spit deflecting the river as far as about 1 mile westwards from the present eastern end of The Bar. In 1702 a new mouth of the Findhorn was formed, and the mouth has altered relatively little since then. Some of the older E ridges may ante-date this breach, but it is impossible to be definite.

The Bar has been shown to be the direct descendant of the Old Bar or spit of the Findhorn. The northern and newer ridges of Culbin all probably date from historic times, with the probable exception of C1, which is mainly a sand ridge with a thin covering of shingle. At the present time there is not much shingle on the Culbin foreshore, and it is not in ridge form. Some shingle apparently still comes from the east, but not in sufficient quantities to form such masses as it has in the past. There is, except for the southern end of The Bar, but little shingle on the Culbin coast until just east of Nairn harbour.

It has not been found possible to differentiate in the ridges the 25- and 15-foot levels, but the fall in sea-level and the westerly drift of shingle have

[1] The B ridges of Burghead Bay may be contemporaneous with, or even earlier than, the Culbin ridges.

been the main causes in giving the present forms. Later the dunes were built, but they are really only incidental features.

The processes described are now seen in action on The Bar. If sea-level were again to fall we should have The Bar and adjacent flats left high and dry. More dunes would gather, and the general appearance would be similar to that of Culbin to-day.

Comparison with the north Norfolk coast has been made from time to time in this paper. Whilst admitting there are obvious differences between the two coasts, it is not unhelpful to point out that if the Norfolk coast were raised we should have a very close parallel with this part of the Moray Firth.

The map of Culbin is the work of Mr. C. A. Fisher; the maps of The Bar and Burghead Bay were made by Mr. W. G. V. Balchin: to both I am very greatly indebted. I would like to acknowledge the help and encouragement I have received from Professor A. G. Ogilvie (through whose paper I was first introduced to this coast), the Rev. J. G. Murray of Rafford, Dr. J. B. Simpson of H.M. Geological Survey, Baillie M. Anderson of Forres, Mr. J. Johnstone, and Mr. A. J. Relton. Dr. H. Dighton Thomas has greatly helped me with the details of the paper. I must also thank the authorities of the Signet Library and of the Register House, and Sir A. Gordon-Cumming of Altyre House for kindly allowing me access to maps.

DISCUSSION

Before the paper the PRESIDENT (Professor HENRY BALFOUR) said: This afternoon we are to hear of a most interesting area of Scotland, that part which lies on the southern shore of the Moray Firth and to the west of the Findhorn, an area in which desert conditions have in comparatively recent times swept over land which was at one time exceedingly fertile. Mr. Steers, who has recently lectured to the Society on the Barrier Reefs, is to give an account of the interesting phenomenon which has produced practically the effect of a desert within our own islands. I will not attempt to anticipate what he is going to say because it is better that I leave him to deal with his own subject.

Mr. Steers then read the paper printed above, and a discussion followed.

The PRESIDENT: Major Bagnold has had vast experience of sand phenomena and movements, so I ask him to discuss the paper.

Major R. A. BAGNOLD: May I refer, first, to the story which appeared in the weekly press of how the estate was overwhelmed one night during a great storm, and the house buried. That cannot be true. Experiments have clearly shown that any given wind can only transport in a given time a certain weight of sand, and no more. As the result of a calculation I made, I found that if a wind were to blow over this area for twenty-four hours at an average speed of 40 miles an hour and the sand which the wind carried on to the area were deposited over a depth downwind of 1 mile, then the greatest thickness of sand which could be deposited would be only 1 inch. Moreover the wind at 40 miles an hour would have to blow against such high resistance due to the sand movement that it would be equivalent, upwind in open country where there was not any sand, to a continuous wind of nearly 70 miles an hour.

Mr. Steers drew attention to the sharp angle on the leeward side of the advancing dune, between the slope of the dune and the ground over which it

was advancing. That is also the case in advancing desert dunes, and, as Mr. Steers mentioned, it shows that the reverse eddy in the wind, which has been called upon to play an important part in dune formation, is negligible at the foot of the lee slope at any rate.

Another point I would like to make is in regard to the general direction in which the sand is driven and its correspondence with the prevailing wind. It is necessary to be very careful how we define the prevailing wind when dealing with sand, because the amount of sand which may be transported in a given time by the wind seems to vary as the cube of the wind-speed. A short storm in one direction could move just as much sand as a comparatively long period of gentle wind in the opposite direction.

Did Mr. Steers do any mechanical analyses of the size-grading of the grains? The size-grading and its changes during sand movement seems to obey certain very simple rules, and in some respects the type of dunes seems to be connected with the grading of the grains.

Those convex or parabolic dunes appear to be typical of river and sea sand in which the range of grain size is very narrow. One does not get that in desert where there is much wider range of grain size.

The PRESIDENT: Mr. Lewis has done a great deal of work in connection with sand phenomena. Would he kindly add a word or two?

Mr. W. V. LEWIS: I am sure we are all most grateful to Mr. Steers for having brought to our attention so vividly this area of quite exceptional interest to students of shore-line physiography. The area has been referred to previously by Professor Ogilvie in two papers, but these do not seem to have received their due attention.

The very excellent maps which were shown on the screen indicated the nature of the complications which exist in the area. Not only is the plan of the shingle and dune ridges complex, but they are further complicated in being at different levels. We heard mention of the cliff following the 50-foot contour line. In front of that are ridges, some of which apparently relate to the 25-foot level, others to the 15-foot level, and still more to the present sea-level. Can Mr. Steers give any indication as to whether further work on the evolution of these ridges might help in tracing those final movements of sea-level from the 25-foot level down to the present? Constructional forms might be particularly useful in this respect as evidence of change of level so frequently depends on erosional forms which are so difficult to date.

The district which is of most spectacular interest, and which we usually associate with the southern Moray shore, is the Culbin Sands. This miniature desert is very impressive. We were shown slides of dunes which approximate to barchans, but a form which interested me particularly when I visited the Culbins some years ago was the parabolic dune which is the ordinary barchan turned inside out. We saw a slide depicting it in the western edge of the area. They are concave up-wind instead of being convex up-wind as in the case of ordinary barchans, though in longitudinal profile, with a gentle slope up-wind and a steep one down-wind, the two forms are similar.

I think I am right in saying that Mr. Steers refers to the parabolic dune as a development of the blow-out which one meets with so frequently in ordinary coastal dunes. I understand that blow-outs have ordinarily blown themselves out by the time they get about 50 yards wide, and then vegetation comes in and they become stabilized. The parabolic dunes, on the other hand, are sometimes 600 yards, if not half a mile, from horn to horn. Apparently the old explanation was that the vegetation holds back the horns of these dunes whilst the centre gets blown forward by the wind, overcoming any vegetational obstacles. I

wonder if Mr. Steers has slightly altered his views, or whether he is not referring to these parabolic dunes when he suggests that they are a development from the ordinary blow-out.

Captain C. DIVER: Whenever I have the opportunity of hearing Mr. Steers on the subject of sand dunes I listen with respect and interest because he is an expert and I am a novice. I hope he will accept the congratulations of a novice on his very interesting paper.

A point that interested me particularly was the obliteration of the Culbin Estate. The story to which Major Bagnold referred is hardly credible: no house could have been covered by sand dunes in one night. Mr. Steers has demonstrated what appears to be a more or less self-perpetuating system whereby material brought northwards by the rivers and southwards by the sea is collected against the southern coast of the Moray Firth which he aptly suggests acts as a groyne. It is then carried westward by currents and piled up until it becomes available for wind action to bring it back eastward again. If that system has been going on for a very long time it seems to me rather surprising that the Culbin Estate remained free from sand invasion for such a long period. Why was not it overwhelmed much earlier? After all, we are dealing with geological time. I do not know the date of the drop in the sea-level, but there must have been a long period when the area was quite free from sand invasion. Then the invasion took place comparatively rapidly, although not at the rate which I understand has been suggested.

I should like to know whether Mr. Steers thinks that the invasion took place by fairly large masses moving slowly, or whether he thinks it possible that over a shorter period of years a blanket, perhaps about a foot deep, was driven in and then steadily added to? I have seen that process on a small scale, and of course a blanket a foot deep is enough to obliterate all existing low vegetation.

The only other point I should like to mention is the use of air-photographs in this sort of work. It would be extremely valuable if some energetic person, or body of persons, could either collect together the necessary money or stimulate the Air Ministry to make air surveys during training flights of a selected series of dunes round our coasts. Many dune areas are rapidly disappearing under development. By means of air-photographs we could get together in a very short time a body of data which should be invaluable to the detailed study of dune formation.

Dr. S. W. WOOLDRIDGE: Although I can claim no competence to speak on the subject with which Mr. Steers has been dealing, it is with great pleasure that I express my appreciation of his paper, and of his other work in the same field. I shall continue to be grateful to him for awakening my own interest in these subjects by one of his first papers dealing with Orford Ness, over ten years ago.

One general point which emerges from such work is that the geomorphologist in this field has the dynamic aspect brought continually before him; he is dealing with processes which move at a measurable rate. That privilege is, to a very large extent, denied workers who are dealing with river action and other erosive activities, but it prompts the reflection that, coupled with this careful survey work—comparative work in successive intervals of time—one also wants experimental data to throw light on the actual processes involved. In other branches of geomorphology our attention is hardly drawn to the possibility or even the value of experimental work, but here we see a succession of results, and we are still largely in the dark as to the precise method by which they are produced.

I would like, if I may, to refer to two or three detailed points which, to some extent, bear that out. I have been puzzled for many years by the general absence

of true longitudinal dunes in our British coastal areas. I wonder whether the extended "blow-outs" to which Mr. Steers and Mr. Lewis referred, are not in embryo the answer to my question. The apparent absence of well-developed longitudinal dunes in this country may be due to failure of observation or there may be some good reason for their absence, connected either with the grading of the sand or the strength and constancy of the winds involved. I should be grateful for guidance on that point.

In regard to the absence of the frontal "apron" at the foot of the steep sand slopes, I should have thought that it reflected simply the relative rate of advance. Surely we may infer reasonably that the apron develops when the advance of the dune is slowed down; any standing period would tend to express itself in the grading or smoothing off of the lower end of the slope. I assume, from what Mr. Steers has said, that, in general, the rate of advance might be considered great enough to support that explanation.

In regard to the shingle ridges, I was a little puzzled as to the nature and origin of the sand ridges, shingle capped, which are sometimes seen between the dunes. Are they the product of wave action, or do they reflect any other process?

Finally, may I express what is no more than an unworthy disappointment that it has not been possible to link the shingle ridges on either side of Findhorn Bay. We have been told very definitely by Mr. Steers that there is no sign of such connection, and I think it is a reasonable inference from the run of the ridges. At the same time, from the general lie of the shingle mass, one would, I think, have favoured that major western diversion which would carry the Findhorn south of Culbin, and in that case, at some early stage following the first drop of sea-level, one would have expected to see a shingle mass linking the two present shores. I would like to ask Mr. Steers whether he regards that as at least a possibility, though I am clear from what he has told us that there can be, at best, little evidence for it to-day.

The PRESIDENT: I think I can certainly say we have been treated to a valuable diagnosis of the peculiar conditions which have produced the Culbin Sands of the present day.

It seems to me that one can well understand the conflicting emotions to which these sands have given rise. On the one hand, we have the economists in the form of the Forestry Commission who want to control the sands. Presumably, the economist would like them cleared away so as to reclaim the land for agricultural purposes, or alternatively to bind the sands up so that they will not spread further. On the other hand, those who practise these economical ventures are spoiling the material for the scientist. One can understand the physiographer's lament over the material, which he wishes to study and has already studied so much, being taken away from him. One can only hope that sufficient will remain unforested for the continuation of the valuable work which is being carried on in the region. And one also hopes that Mr. Steers will still have material for study which will throw even more light on the spread and formation of these sands in general.

Personally, I am not in the least qualified to comment upon a paper dealing with these physical phenomena, but Mr. Steers mentioned the fact that the area which is now covered by the Culbin Sands was at one time well populated. Evidently it must have been fairly heavily populated in late Neolithic times, or at the end of the Stone Age and the beginning of the Bronze Age, because vast numbers of implements, mostly arrow-heads, have been discovered there, pointing to a rather considerable population. Mr. Steers has not mentioned one feature in regard to those finds, which is that nearly all the implements which were found in the area from Stone Age time are glossed in a remarkable

manner, which makes the Culbin Sands finds easily distinguishable from those of almost any other part of Scotland. I do not know whether Mr. Steers has views as to the way in which this gloss was effected; whether it is due, as presumably it was, to erosion from blown sand and whether in that case it was due to any particular formation of the sand granules? Has the fact that they are, as I believe, very rounded in their form, a direct bearing upon the erosion of the surfaces of the flints? It is a point I would like information on, because the glossing of flint implements was very marked in the district.

I think, as time is passing, I should now ask Mr. Steers to reply to the questions which have been asked or points which have been brought forward in the course of the discussion.

Before asking him to rise I would ask you to express what I am sure you feel, very hearty appreciation of the way in which he has presented an extremely interesting piece of work.

Mr. J. A. STEERS: I can give no answer to the point raised by the President, other than saying that the sand-blast will obviously polish the pebbles. There is however more to be explained than that.

Precise measurements of wind-direction have not been used in my account. For the purpose I had in view I think it was sufficient to take winds between north-west and south-south-west as prevalent—and probably it is not far wrong to take south-west as approximating to the average direction of the prevalent winds influencing the Culbin area. I did not carry out any experiments in sand-grading: I was primarily concerned with the evolution of the area. I hope that Major Bagnold will find time to carry out some of his own important investigations on the Culbin dunes. A great deal of work is necessary in many branches of science before we have the full story of this part of the Moray Firth. It could be an admirable area for team-work similar to that carried out on Scolt Head Island.

The fluctuations of sea-level are dealt with in Professor Ogilvie's paper. Whilst shingle areas such as those described in my paper are important in establishing former levels, I think that beaches and similar features cut in solid rock outcrops around the whole Firth are of greater significance. I am sceptical of the value of using ridges and dunes in this way, unless strong corroborative evidence is found elsewhere in the neighbourhood. If a careful pollen-analysis were to be made of the various peat beds I believe some extremely interesting results would be obtained. There are peat beds in the shingle cliffs of Burghead Bay, above the shallow quarry on the north side of the road at Kingsteps, and again at higher levels above the boulder clay in the quarries to the south of the same road. It might even be found that a similar examination of old land surfaces in the Culbins would be well worth while.

I am glad Mr. Lewis called attention to what I said about parabolic dunes and blow-outs. I think there is much in the explanation that the sides of parabolic dunes are held more firmly than their mid-parts by vegetation. On the other hand a normal dune mass may have been stable for some time, and then erosion may—for easily imagined reasons—begin and cut a hollow or blow-out. This may develop further and easily become a cut through the original ridge. I think it is also possible that instead of a gap being formed, the sand may continue to move down wind as an advancing dune—*i.e.* a parabolic dune. In case I have made my statement too definitely, I should say here that I do not regard all parabolic dunes as extended blow-outs. A simple blow-out or gap would most easily form when erosion cuts at right angles into a rather narrow dune ridge. If, on the other hand, erosion, as seems to have happened in parts of Culbin, cuts into a ridge along its axis, an elongated hollow hardly distinguishable

except for its narrowness from a true parabola, may be formed. I am not sure, but I take it that the true parabola is formed when a dune ridge running transversely to the wind is moved forward most in its middle parts.

I agree generally with Captain Diver's view of the inundation of the Culbin Estate. The cycle of events to which he refers has been commented on by many observers. The sand seems to have gathered to the west of the Estate, and gradually to have advanced on to it. The storminess prevailing prior to 1695 (*cf.* Breckland) must often have carried much sand on to the Estate and gradually rendered it useless agriculturally. I strongly support Captain Diver's plea that official bodies should be urged to carry out air photography of dunes and other areas. Such photographs would be invaluable to the physiographer.

I am afraid I cannot answer some of Dr. Wooldridge's points at all convincingly. I imagine that longitudinal dunes are generally absent from this country partly because there are no sufficiently big and arid areas in which they could develop, and partly because in all coastal areas I know vegetation plays too prominent a part. The northern Culbin dunes are fore-dunes, and I do not think a true longitudinal dune occurs. Physiographically, if not in other ways, I regret that I have not seen a gale at work in the Culbins. The steep lee slopes of the dunes are certainly characteristic of normal weather, and from what I have seen in fairly windy weather, I think they are likely to prevail at other times. Of course, during gales, a thin sheet of sand would be blown on the flat in front of them, but the sand streaming over the dune would, I think, continue to fall down the steep slope, and be the main cause of the dune's advance.

I should much like to be more definite about the order and relation of events on either side of Burghead Bay. At present I do not know how this problem can be tackled. The historic deflection of the Findhorn was as shown on May's map: I think it more than likely there were earlier deviations, but the evidence is buried.

ROBERT HOOKE AND THE CARTOGRAPHICAL PROJECTS OF THE LATE SEVENTEENTH CENTURY (1666–1696)

E. G. R. TAYLOR

Paper read before Section E of the British Association for the Advancement of Science, 2 September 1937

THE Great Fire of London changed many lives. John Ogilby, the elderly Master of the King's Revels in Ireland, lost the entire stock of his printing and bookselling establishment in Fleet Street, and had to start business afresh. Fortunately however there was plenty of work to be done. Both Ogilby and his young kinsman and assistant, William Morgan, obtained from the Corporation of London appointments as "sworn viewers" of the devastated City, in which obliterated property boundaries had to be re-established. Almost simultaneously Robert Hooke, then Curator of Experiments to the Royal Society, accepted a City Surveyorship in connection with the rebuilding schemes. His promptly produced model (or rather plan) of a New London, exhibited at the Royal Society's meeting on 19 September 1666, had struck members of the Corporation invited there to see it as a far finer piece of work than the official plan submitted by their own chief Surveyor. Hence this new appointment. Circumstances thus brought Ogilby and Hooke into close professional contact, and opportunity arose for the latter's universal genius to be brought to bear upon the cartographical projects which were soon to be associated with Ogilby's name. Nearly a century had passed since Saxton first surveyed the English counties. Ogilby proposed to re-survey them, and to prepare besides a series of accurate plans of the principal cities of the realm.

Hitherto he had not interested himself in geography, but among the first of his publications after the Fire was a translation of a popular Dutch work on China, 'Embassy from New Batavia to the Emperor of China,' licensed at Stationers' Hall on 21 January 1667. This book he sold through a lottery, and as it proved a success (for so many private libraries had been burnt and needed re-stocking) he followed it up two years later by a 'Description of Africa,' also from a Dutch original. It was then that (as he tells his prospective readers) "feeling a spring of youthful vigour warming my veins with fresh hopes of better times," he began to plan, on a still grander scale, "a new model of the universe, an English Atlas." For this ambitious work he obtained a licence on 1 November 1669, with copyright for fifteen years (*i.e.* until 1684). The title proposed was 'A Description of the Whole World, *viz.* Africa, America, Asia and Europe,' which was to appear in four volumes, continent by continent. It was only subsequent to this date that Ogilby decided to add a fifth volume, to be entitled 'Britannia,' by which, as events proved, his work and name were to live. This fifth volume was planned in three parts: a road survey of England and Wales, a set of twenty-five city plans, and a county survey accompanied by a complete topographical description of the Kingdom. As is well known, only the Road Book was completed; the city and county surveys remained mere fragments. The decision to use the

general title 'The English Atlas' was taken only at the last minute, and appears merely on a crudely printed supplementary title-page to Volume I, 'Africa,' which came out on 28 April 1670.

There is no doubt that in making these plans Ogilby had been influenced by the rival project announced by Richard Blome, who had also in mind an English Atlas. English libraries of the day were furnished with the splendid and monumental Dutch and French Atlases of Blaeu, Jansson, and Sanson, which many a publisher was anxious to supersede. That Blome also saw the opportunity offered by the destructive work of the Great Fire is suggested by the fact that by 1667 he already had the English engraver, Francis Lamb, at work upon Sanson's maps which he designed to re-issue. Not until 28 July 1668 however did he apply for necessary licences at Stationers' Hall, and soon after this date he issued a printed prospectus of his proposed publication with an appeal for subscribers. Volume I was to treat of 'General Principles,' and for this purpose it was intended to translate the deservedly admired 'Geographia Generalis' of Varenius into English, and add to it one hundred maps. Volume II, a translation of Sanson, was to bear the title 'A General Description of the Four Parts of the World,' while Volume III was to contain a 'Description of Britain.' Volume II was due to appear in the summer of 1669, and when it was well forward, Blome approached the Royal Society for their advice and approval. A Committee, including the names of Lord Brouncker, John Evelyn, Christopher Merret, and Nicholas Mercator, was appointed, but merely gave the work a general certificate of approbation. The Preface to Volume II, which duly appeared, is dated 26 September 1669, and whether at Lord Brouncker's suggestion or no (for he was interested in sea matters), the scope of the work had been enlarged to include as a further volume, 'A Hydrographical Description of the World,' intended to supersede the Dutch "waggoners" or pilot books then in general use. Before this could be got under way however Blome found that he had been forestalled by a well-known nautical instrument and chart-maker, John Seller. The latter obtained a grant of thirty years' copyright by Charles II for an 'English Pilot' and 'Atlas Maritimus' as from 22 March 1671. The date of Seller's Preface to the first-named volume (10 November 1670) indicates its probable completion some time before its actual issue, and although it was in the main no more than an English version of a French original, it precluded any similar publication by Blome. With his description of Britain which (like Ogilby) he called 'Britannia,' he was more successful. Advertised on 13 February 1671 as "ready for the Press," it appeared later in that year, but proved to be little more than a re-hash of Speed, illustrated by his county maps, and by Sanson's general map of Britain re-engraved by Francis Lamb. Volume I, the translation of Varenius' 'Principles,' never appeared, although Isaac Newton re-edited it independently in the original Latin in 1672.

Meanwhile, fearing to lose his market, Ogilby advertised in the Term Catalogue for June 1670 his intention of publishing his fifth volume ('Britannia') before Volumes III and IV ('Asia' and 'Europe'), and in a further advertisement rather more than a year later declared that it was "ready for the Press." This was very far from being the case. Not until 24 August 1671 did he obtain the Royal Warrant which ensured for him the local facilities

and assistance necessary for a direct survey, and not until February 1672 was his prospectus and appeal for subscribers printed. By Midsummer 1672 however he could report that he had "actually surveyed several counties," although according to the available evidence the word "several" covered only Kent and Middlesex.

Although an old man, Ogilby himself, accompanied of course by the assistant who actually used the instruments, seems to have carried out the work in Kent, the expenses being borne in part by the Archbishop of Canterbury, Sheldon, whose steady patronage of learning is well known. The map was engraved by Francis Lamb, who had done cartographical work for Blome. Sir Thomas Wolstonholm became the patron of the map of Middlesex, which was engraved by Walter Binneman, and Hooke purchased a copy early in 1673.

It was while these two county maps were in course of engraving, that is to say in 1672, that an extremely able young man was recommended to Ogilby as his general assistant by the famous engraver, Wenceslaus Hollar. This young man was Gregory King, the son of a Lichfield surveyor and mathematical teacher, who had helped his father professionally when a mere child. From the age of fourteen he had been employed by Sir William Dugdale, who was then engaged on heraldic surveys, and in the course of copying coats of arms and inscriptions, King had developed exceptional skill in lettering and ornament. Directly he entered Ogilby's service, he set to work to put into order the material already collected for the new 'Britannia,' and (what was more important), assisted to arrange for the further finance of the enterprise. Entries in the Treasury Books show that Royal assistance had been extended to Ogilby since 1670, but it took the form, not of ready money, but of licence to import certain quantities of printing paper duty free. Given the title of King's Cosmographer, he petitioned for a small salary to accompany it, which was granted to the extent of 20 marks a year, as from September 1672. Both the King and the Queen had headed the list of subscribers to the 'Britannia,' each promising the sum of £500, but the money was not forthcoming, and in October 1673 it was commuted for an equivalent further relief from the customs on imported paper. Ogilby's need however was for ready cash to pay for the surveys, and Gregory King's first step was to organize, on his behalf, a standing lottery in London and another at Bristol. The latter was for the period of St. James' Fair, and King attended to it himself. The necessary licence had been obtained in December 1672, and the London lottery was announced in the Term Catalogue of February 1673 as follows:

"Mr. Ogilby's office for carrying on his Description of Great Britain and his General survey of England and Wales by way of a standing lottery, is kept at Mr. Garaway's coffee-house in Exchange Alley, near the Royal Exchange."

This particular coffee-house was the daily place of resort of a number of the Fellows of the Royal Society, prominent among them being Robert Hooke and his closest associates, John Aubrey and Sir Christopher Wren. These three men were consulted by Ogilby, who brought with him young Gregory King, and as a result of several conferences, a set of 'Queries' was

drawn up and printed, intended for circulation among persons in a position to supply topographical and other information for the text of the 'Survey of England and Wales.' There can be little doubt that it was Hooke who was responsible for the strong geographical flavour of this document, which included queries about the natural vegetation cover, land utilization, settlements, mines and quarries, mills, bridges, beacons and mountains, as well as the more usual ones concerning antiquities and gentlemen's seats.

Aubrey, who had by this date lost his private fortune and estate, had for long been interested in topography in its narrower sense, and was engaged upon a 'Natural History of Wiltshire.' It was easy therefore for Ogilby to enlist his services, and in May 1673 he formally appointed him his deputy for the Survey of Surrey. Two months later, on July 1, Aubrey commenced his perambulation, and by the middle of September he was going over his work with Ogilby and Hooke at the coffee-house, whence he carried it presently to Sir Christopher Wren. About this time however Dr. Plot was formulating his scheme for a series of county surveys on rather different lines, a scheme which secured the warm support of Wren and Hooke, so that Ogilby discontinued further work in this direction. His map of Essex was however already in manuscript, although not until 1678, two years after his death, was Francis Lamb employed to engrave it. For the perambulation of this county he had employed a local surveyor named Falgate, with whom he sent Gregory King, the work being done in the winter of 1672–73. In spite of the very severe weather the two men also drew plans and "prospects" of Ipswich and Maldon, copies of which, "very curiously finished," were sent to those towns, most probably with a view to obtaining subscribers. It is possible that a map of King's Lynn, advertised for sale in 1676 as "of Ogilby's," but otherwise unknown, was also drawn at this time.

While, as it seems, the county survey was now laid aside, Ogilby still had his hands full with the other two proposed parts of 'Britannia,' namely, the road survey, and the survey of London for the first of the twenty-five English city plans. Gregory King in his autobiography relates that he found both pieces of work in progress when he entered Ogilby's service, although neither was being handled at all competently until he himself introduced a more business-like method of procedure. Among several surveyors whom Ogilby was employing, the names of two very well-known men appear, namely Richard Shortgrave and William Leybourne, the former working on the road maps, the latter on the map of London. Both were men with whom, as his Diary shows, Hooke was in continuous touch, for he worked with both on property surveys for the Corporation of the City of London. Shortgrave was responsible for preparing and engraving the maps of three of the southern English roads, King did the same for two northern roads, but the remainder of the maps are unsigned, and it is not possible to assign to them any exact authorship. That Ogilby himself took part in much active survey work subsequent to 1673 is unlikely in view of his age and increasing lameness.

During the two years which preceded the actual publication of 'Britannia,' or rather of Part I, the Road Survey, Hooke records in his diary over sixty meetings with Ogilby, at which sometimes Aubrey, sometimes Shortgrave, and sometimes "his man King" were also present. Not only did Hooke give

advice and assistance in regard to the maps themselves, he did his best also to lighten the financial burden which they imposed upon Ogilby by giving him influential introductions and helping him to prepare appeals to public bodies. The history of the great 'Map of London,' finally published by William Morgan in 1677, can be traced in some detail. As already mentioned, William Leybourne was in charge of the actual surveying. He had been one of six professional surveyors chosen by the Corporation to re-survey the City immediately after the Great Fire, his colleagues being John Leake, John Jennings, William Mair, and Thomas Streete, all men of good professional standing. Their six-sheet map, reduced to a single sheet by Leake, was engraved by Hollar in 1667. Since that date of course rebuilding had been rapid, and Leybourne began by surveying the streets and lanes afresh for Ogilby on a scale of 50 feet to the inch. Ogilby left the first draft sheet with Hooke on 19 July 1673, and during August a series of conferences was held with Hollar at which it was decided to make the final scale 100 feet to the inch, and to show not merely the roads, but the detail of each building and garden. King, in his autobiography, claims to have been responsible for these decisions, and no doubt he was present at the discussions and allowed to voice his opinion. Hooke however designed the general lay-out of the map, which was to consist of twenty sheets. The etching was done by King, and on 8 December 1673 Ogilby brought Hooke the first finished sheet from the engraver, Hollar. A second was ready on January 9. At that time however the actual surveying was far from complete, for Leybourne remarks, in the edition of his 'Surveyor' published in 1674, that he still had several months' work to do.

The two specimen sheets however were to be the means of obtaining monetary support, and immediately on the receipt of the second, Hooke wrote for Ogilby a report to the Court of Aldermen, and accompanied him on a succession of visits, first to the Lord Mayor, then to the Sessions House, and on January 29 to the Court of Aldermen. Two draft appeals by Ogilby to the Court for assistance are preserved in manuscript (Add. MSS. 3958 fol. 16), and these were no doubt prepared by Hooke. They refer to the specimen sheets available for inspection, and to the "draughts and prospects of all the famous buildings" with which the completed map was to be adorned. The original manuscript map, suitably illuminated, was to be presented to the City. The subscriptions of £500 apiece promised by the King and Queen to assist the whole project of 'Britannia' were referred to, and the generous support of the City asked for "so that London may be an example for the rest of the cities" which it was proposed to map in a similar way. As appears from this document, Ogilby had been given the Corporation's Warrant to carry out his survey, and a further unsigned and undated document records the conveyance to him of the sole privilege of mapping and describing London. Here reference is made to the material that was simultaneously being collected for a historical description of the City, and this was subsequently embodied in the "long quarto" volume, entitled 'London Surveyed: or An Explanation of the Map' which accompanied the issue of the map in 1677. This volume also appears to have been prepared by Hooke, for an entry in his Diary for 19 March 1674 runs: "At Spanish coffee-house with Ogilby. Drew the uses

of the London map." His further services included drawing up for Ogilby an address petitioning for access to the City records, drawing up for him addresses to the Justices at Hicks Hall and to the Merchant Taylors Company, besides bringing him constantly into the useful company of Mr. Hill, then the treasurer of the Royal Society.

It was one of Hooke's most valuable traits that he was a keen technician as well as a man of ideas and a devotee of experimental science. It can hardly be doubted that it was Ogilby's proposed new road survey that suggested to him the invention in the opening of 1671 of what he termed a "chariot way-wizer." This was a carriage or "calash" in which the surveyor could ride at ease, while by a mechanical device both the distance and the direction travelled were directly recorded on a sheet of paper before him. This invention was shown to the Royal Society on 8 June 1671, and a description of it was found among Hooke's papers by Richard Waller after his death. That it was brought to Ogilby's notice is borne out by his specific mention in the Preface to 'Britannia' (Part I) that he preferred the foot-wheel of half a pole circumference "with the Way-Wizer as now regulated, to any Coach or Chariot Mensurator." The engraved Frontispiece shows the master-surveyor on horse-back, while his assistant pushes a perambulator type of way-wizer which indicated on a dial the number of turns made. Such a slow and laborious method of procedure could not satisfy Hooke's impatient mind, so eager for mechanical efficiency, and in January 1674, when he was meeting Ogilby almost daily, he writes in his diary, "contrived pacing saddle with way-wizer." Now nearly ten years earlier (according to a list of proposed experiments) he had the idea of a "springy saddle on two wheels," and it would seem therefore that he anticipated the eighteenth-century velocipede, and planned to combine it with a surveyor's perambulator. Another improvement which Hooke was very anxious to introduce was the attachment of telescopic sights to surveying instruments, and he explained the use of a telescopic sight-rule to the surveyor Richard Shortgrave at about the same time as he was contriving the saddle way-wizer. But current surveying technique was still that devised for estate surveys, and the surveyors themselves were very conservative in their attitude, whereas Hooke was following with close attention the mapping by accurate triangulation recently begun in France. The year 1672 had in fact been memorable in the annals of cartography, for it was the year in which the Royal Society received the report of Picart's precise measure of a degree of the arc of the meridian.

There was still another direction in which Hooke believed he could effect improvements in map production, and that was in the actual engraving. On 14 October 1673 he notes in his Diary that he showed Ogilby "the way of letters for making his map and also the way of shadowing." The latter seems to refer to hill shading, which was carried out in several different ways on the Road Maps. So far as lettering was concerned, Hooke believed that expense could be saved by making engraved alphabets, and using them like moveable type, and this was in his mind when he was examining the "marginal metal for Ogilby's letters and borders" in January 1675, when the first part of 'Britannia' was at last ready for the press. The last of his voluntary tasks in connection with this particular publication was to direct Gregory King

how to prepare the pocket epitome of the road sheets, since the handsome folio volume itself was not likely to be carried by the traveller. These road tables were immediately pirated by Basset and Chiswell in their new edition of Speed, as Ogilby complained in a letter to the Secretary of State.

By June 1675, John Ogilby's health was definitely failing, and he began to transfer his responsibilities to his kinsman William Morgan, who in November was confirmed by Royal Warrant in the offices of Cosmographer Royal and Master of the Revels in Ireland. Within a twelve-month the old man was dead, leaving his unfinished project for a complete 'English Atlas' to Morgan as a sacred trust (or rather as a grievous burden). Expenses had already exceeded subscriptions by many thousands of pounds, and Morgan was unequal to the task of financing further work. The 'Map of London' was however practically complete, and it appeared in the New Year of 1677 with a dedication (signed by Morgan alone) to the Lord Mayor. Hooke received his complimentary copy on February 7. Morgan next set Francis Lamb to the task of engraving the unpublished map of Essex, which came out on 14 May 1678, and the Treasury Books show that, like his predecessor, he was allowed to import for it a certain amount of printing paper customs free. In a despairing advertisement inserted in the Term Catalogue of February 1680 he declared that "by God's assistance" he would still finish Ogilby's Atlas, but in fact owing to lack of capital the whole project lay dead. The City of Westminster had however already been surveyed in detail by King and Falgate during 1674–75, and in 1682 Morgan brought out a new map of London including Westminster, together with a long prospect or panorama of the two cities. For this he received a gift of £200 from the King's Privy Purse, and on April 5 presented a copy to the Royal Society, with a covering letter to Hooke asking him to procure for it the Society's good word.

Meanwhile Dr. Plot, the "English Pliny," had successfully launched his own series of county Natural Histories with the Oxford volume, which appeared in April 1676. By 1680 he had ready the map of Staffordshire (possibly with help from Gregory King), and this second volume was confidently expected in the following spring. Actually it was not published until 1686, and at the rate of ten years to a county, completion of the scheme for all England was hopeless. John Aubrey begged Plot to take over the material that he himself had collected for Wiltshire, but Plot had planned Kent as his third county, and the Wiltshire material was therefore taken over by Thomas (afterwards Bishop) Tanner, but again never completed. Since such work was clearly not for a single individual, Hooke had proposed to his friend John Beaumont to undertake the 'Natural History of Somersetshire,' and a draft prospectus was printed in 1685, but the unsettled state of the country caused the abandonment of the project. Charles Leigh's 'Natural History of Lancashire' met with better fortune. Planned in November 1684, it was actually published in 1700, but it does not bear comparison with Plot's work, in so far as its geographical interest is concerned, and indeed the whole series lacked the general appeal of an 'English Atlas' as planned by Ogilby with new county maps as its special feature.

This fact was appreciated by a good many printers and mapsellers, and the

collapse of Ogilby's project brought others into being. John Seller, who had produced the 'Atlas Maritimus' in 1672, had also published a new map of Hertfordshire in 1676 under the patronage of the Earl of Essex, then Lord Lieutenant of the county. This he made the starting point of a more ambitious plan, for which he took as partners a surveyor and an engraver. The former was John Oliver, a man familiarly known to Hooke as another of the "sworn viewers" after the Fire. The latter was one Richard Palmer. As Hydrographer Royal, Seller secured Royal patronage, and a letter from King Charles dated from Windsor on 15 September 1679 refers to the scheme as "a great and elaborate work of an actual survey of England and Wales, comprising complete maps of every county in a large book in folio entitled 'Atlas Anglicanus.'" A grant in aid of £200 was received in March 1680, but all that was accomplished was the re-issue of the map of Hertfordshire, and the issue of new maps of Middlesex, Buckinghamshire, and Oxfordshire. This enterprise then likewise lapsed for lack of money.

Meanwhile, a much more serious undertaking was being planned, namely a survey of England and Wales as a whole upon an astronomical basis, and this naturally had the support of Robert Hooke. The proposer, John Adams of the Middle Temple, had first become interested in maps in 1672 when he had discussed a map of market towns with a Welsh friend in connection with a scheme for selling more fish. On coming to London, he had in 1677 drawn and engraved a large map of England and Wales of a gazetteer type, the lettering and ornament being by Gregory King, who although he had obtained the office of Rouge Dragon after Ogilby's death, still found it necessary to earn money by his special talents. Hooke advertised the map in his 'Philosophical Translations' and received a complimentary copy from Adams, who was well known to him, and had indeed sought the advice of the Royal Society. A similar gift to the Benchers of the Inner Temple was rewarded by an honorarium of ten guineas. In the following year (according to a letter that has survived), Adams was inviting the Archbishop of Canterbury to buy a copy at a slightly reduced price, excusing his importunity by the necessity of raising money for his coming 'Index Villaris.' This gazetteer of place names appeared in 1680, and Gregory King prepared a reduced and revised version of the original 6-foot map of 1677 to accompany it.

It was in his Preface to the 'Index' that Adams first announced his wish to carry out an actual geodetic survey of the whole realm, and less than six weeks later, that is to say in the New Year of 1681, he had sent specific proposals to the Royal Society. The scheme had been in his mind since 1676, but it was not until he formed the conclusion that Morgan's and Seller's respective plans for an 'English Atlas' had finally broken down that he felt free to take any action. His prospectus must have been issued in December 1680, for there is a letter from him extant dated December 24 acknowledging a subscription of £10 from the Archbishop of Canterbury, and undertaking to deliver to him the advertised volumes in due course.

When, on January 26, Adams was introduced in person to the Royal Society by Dr. Nehemiah Grew, it was announced that his advisers included Robert Hooke, the President (Sir Christopher Wren), and Flamsteed (the Astronomer Royal). It had earlier been stated that Newton, too, had promised

to assist him, and that the map was to be based upon three meridians run clear through England from south to north. The plan was therefore on the lines of recent and proposed work in France, demanding precise astronomical observations besides considerable technical ability. In May, the Royal Society appointed an advisory committee, the members of which were Hooke, Dr. Pell, Sir John Hoskyns, and Hill; and Adams exhibited one of the instruments he proposed to use. This was a quadrant, with telescopic sights of the type advocated by Hooke, and is indicative of the precision with which it was proposed to work. In the following month a Royal Order was issued empowering Adams to go freely to all necessary places and view points, such as hill-summits and steeples, in order to prosecute his survey, and from an incidental reference in a letter to Hooke from a friend written in November, we gather that from the outset he was accompanied by no less eminent a man than John Caswell, of Hart Hall, Oxford, and a member of the Oxford Philosophical Society. The finished survey was promised to subscribers by Lady Day 1685.

A precious letter written by Adams to Hooke on Christmas Eve 1681 indicates something of his method of procedure. "The last time I waited upon the Royal Society (he writes) I promised the president to write to you, but my genius little inclines me to observe natural and artificial rareties, and on that account, Dr. Plot hath much the advantage of me, my present care being to continue a series of triangles throughout the kingdom from eminent hills and steeples. My basis was in King's Sedgemoor, Co. Somerset, from a place called Compton Dundo Beacon to Bridgewater spire, being about 12 miles and 10 of it as level as the sea. From thence I have intersected Glastonbury Tor and several other places, and in my triangles some sides are fifty miles. Proceeding on to Devonshire in August last, I read the 15th chapter of Proverbs by lightning in a small 8vo. print about 11 at night. The flashes were not sudden, but continued so as to let me read about twenty words at a time, sometimes more or less.

"In November last, in the top zone of the highest hills in Wales, I was to the middle in snow, a driving mist wetted our hair, then a clear air freezed it, then comes more mist and so more ice, and yet it was very warm in the low grounds adjoining.

"I have travelled 7000 miles, and will ply this undertaking Winter and Summer till I finish it. I much want good glasses (telescopes), and if you would do me the favour to give yourself the trouble of buying two or three for me about 7 or 8 foot long, I will, upon your letter to Shrewsbury return you £5 or £10. I intend next Spring to measure one of the highest hills in Wales from the level of the sea, and still to proceed by taking the plumb line in height and the progression by level. I intend to take it several ways, as by the difference of altitude (angle of elevation) at nearer approach, comparing this altitude backwards and forwards with hills remote from it.

"I beg the Society's advice, and that you will pardon this trouble, etc. Posthouse in Shrewsbury 24th December 1681."

Adams was at work in the Severn Basin during January, and made (as we learn from a report by Caswell to the Royal Society) many determinations of levels and altitudes, the first observations of this kind ever carried out in

England. But members of the Royal Society were interested, not so much in the geometrical method referred to by Adams in his letter, as in determinations by the mercury barometer such as had just recently been attempted in France. Urged by Flamsteed, Caswell applied this method to Snowden, and on 17 July 1682 found its height to be 3720 feet. Similar measurements were made of other prominent heights, as, for example, Cader Idris on July 26, the Stiper Stones on September 8, and the Wrekin, which was put down as 1398 feet, but unfortunately beyond one or two letters to the Royal Society, no records of Adams' surveys have survived.

By 1684 he could claim to have travelled 25,000 miles. He had worked through the Hearth Tax books twice for details of settlement, and had obtained a mass of information by direct inquiry. But in spite of subscriptions received from the Lords of the Council, the Universities, and some hundreds of individuals, not a single sheet was printed or engraved. Adams therefore hit upon the expedient for making his work of immediate monetary value to the State so as to secure a Treasury grant. His proposal was to prepare a revised Hearth Tax book for each of the fifty-two counties, based on the information he was collecting, the existing books being, as he had found, very deficient, so that many hearths went untaxed. He had an interview with the Treasury Lords on 2 July 1684, when it was agreed to pay him £100, in return for which he was to provide the first new county book by Michaelmas, the second two months later. But even working at this rate, progress would have been too slow to be useful. Meanwhile Charles II died, and was succeeded by a King who took little interest in science or philosophy. No county maps were ready for the subscribers on Lady Day 1685, and a year later, Adams was reduced to putting before the Oxford Philosophical Society the suggestion of dealing with the topography of single parishes, of which he sent them a specimen. This proposal likewise came to nothing, and the last we hear of John Adams is in a pitiful letter written in the summer of 1688 to his chief patron, the Archbishop of Canterbury, who to the horror of the English public had been thrown into the Tower with six of his suffragans. Adams himself had been seized with a fever from which he believed himself unlikely to recover. In the new reign, he declared, he had found the country gentry reluctant to impart information, even the men of science were unhelpful, and observing that he lacked support, his many creditors had now closed in upon him. His promise of a county survey must remain unfulfilled, and he could only beg for the Archbishop's pardon, for to return the subscription was beyond his powers. So ends the first scheme for a triangulation of Britain. From a casual note in the margin of a MS. map of Staffordshire, made probably by Gregory King, we learn that the scale was to be 2 miles to an inch. This map is dated August and September 1680, and was no doubt an experimental sheet made when Adams had decided on his undertaking. Some of its features were incorporated by Dr. Plot into the map of the same county upon which he was then working. Another documentary fragment which has survived relates apparently to the scheme of maps proposed by Seller and his partners, for here the scale mentioned is 3 miles to an inch, and the method of survey is to be by measuring merely distances and bearings. An earlier survey (presumably Ogilby's) was to be incorporated, and the

estimated cost, assuming the older work to be projected anew, was £1441 5*s*. Alternatively if the old projection were used the cost would be only £850. In this estimate, a shilling a mile is allowed for the actual perambulation, £8 a plate for the engraving, together with 25*s*. for the copper plate itself. The survey of one hundred capital towns on a scale of 500 feet to an inch is put down at 20*s*. apiece, which appears to be a serious underestimate, as does a sum of £100 for insertion of topographical detail into the existing road survey. But whatever the estimated cost, such a scheme was beyond the means of the private individual and his subscription list: it demanded national effort and support.

While Adams and Seller had fallen, as it were, heirs to the 'Britannia' volume of Ogilby's scheme, his 'English Atlas,' in its wider sense of a survey of the world, was not forgotten. In 1677–78 a notable London publisher and bookseller, Moses Pitt, formulated a scheme for a vast publication in twelve volumes which he too entitled 'The English Atlas.' It was to contain the latest and best maps of all parts of the world, supplemented by introductory text and indices. Hooke, who knew Pitt well, was instantly enthusiastic about the scheme, and from the date of his appointment (28 March 1678) to the Royal Society committee charged with the supervision of the Atlas, he devoted to it a large proportion of his time.

Nevertheless, as between the man of science and the man of business, dissensions were inevitable. So far as Pitt was concerned the situation was this. The famous Dutch printing house of Blaeu had been destroyed by fire in February 1672, when the stock and many of the copper-plates of the magnificent Blaeu 'Atlas' perished. Hence there could be no further copies issued. The plates of the rival Atlas, that of John Johnson (Jansson), had been purchased by two Dutch printers, Stephen Swart and Waesberg, who were friends and correspondents of Moses Pitt, and it seemed likely that an English issue of Jansson would find a good market. Pitt proposed, with Swart's help, to correct the plates, and re-engrave them where necessary. He was not prepared for the sweeping revisions and the large number of new plates which Hooke envisaged, and which were indeed essential if the new Atlas was to be up to date and complete. Hooke moreover was convinced that an immense saving could be effected (as he had already hinted to Ogilby) by overprinting the place-names separately on the map, instead of engraving them on the plate. Without disclosing any details he secured from Pitt a promise of £200 in consideration of showing him "My contrivance for making maps," together with a further £200 for supervising the production of the Atlas. When, against Hooke's advice, the use of the old plates was finally decided upon, Pitt repudiated the contract and became to his former friend "the rascal Pitt."

Nevertheless Hooke did an immense amount of work in respect of the Atlas, and during eighteen months, down to 26 September 1680 when he wrote in his Diary "Finished Atlas," he was in constant conference with the other members of the Royal Society Committee, with Pitt himself, with Swart and with the three engravers, Francis Lamb, Cramer, and van der Houve, who were employed in making various plates and illustrations. In point of fact it was only Volume I of the Atlas (dealing with northern

Europe), that was finished and published in the autumn of 1680. Hooke was responsible for the introductory letterpress, and most probably for a new general map of the northern regions on a polar projection. But apart from this, the Atlas was simply a re-issue of Jansson, with the lines of longitude revised so as to refer to a single prime meridian in accordance with Hooke's demand. John Adams was writing the preface to his 'Index Villaris' just when the 'English Atlas' Volume I appeared, and no doubt voiced Hooke's view as well as his own when he pointed out the worthlessness of publishing out-of-date maps. Henceforth Moses Pitt had to find other advisers, less familiar than Hooke with the progress of exploration and cartographical methods. He struggled on, but the lease of the Oxford Press and the purchase of new founts of type had involved him in heavy expenses. A brief imprisonment interrupted progress, and by 1691 only four volumes had appeared, capital being lacking to print off the fifth for which the material was ready. Charles II had encouraged him with a gift of £300, but subsequent to 1685, as has already been made clear, the times were out of joint for scientific work. Pitt's 'English Atlas,' like its rivals, was never brought to completion.

Celestial maps, no less than terrestrial, interested Robert Hooke, and he helped Francis Lamb to design, prepare, and publish a pair of celestial planispheres in 1679. He also assisted Halley in the publication of his new star catalogue of the Southern Heavens, the accompanying map being engraved by James Clerk, who had accompanied the youthful astronomer to St. Helena. Yet there was one great cartographical project with which, surprisingly, he had nothing to do: the first English coastal survey, carried out by Captain Grenville Collins, and begun in 1681. This practically one-man survey took seven years, at the end of which time Collins was petitioning for £1400 arrears of payment due to him. Nearly five years more was required for engraving the plates, so that the 'English Coasting Pilot' did not actually appear from the press until 1693, when Dutch William was on the throne. Hooke stigmatized it as very inaccurate, and sketched out what he believed would be a better method of sea-survey, using the length of the ship from bowsprit to stern as fixed base. But in practice this could have effected no improvement, whereas Collins' charts were certainly much more accurate than their Dutch predecessors, and marked a definite advance that established for the first time a truly English maritime cartography.

Land survey still lagged behind. In 1686 Halley planned and attempted to re-measure the arc of a meridian by triangulation, but the technical difficulties were too much for him, and he soon abandoned the idea. In the reign of Queen Anne, Whiston put forward a scheme for a survey, based on his device for determining longitude, but it met with no support. The civilian has a score of uses for a map, but whereas utility can only plead, the necessities of war can command. The Rebellion of '45 brought home to the military the difficulty of subjugating unmapped country, and William Roy, whose lot it was to execute the new map of Scotland, lived to become the father of the English Ordnance Survey. Just over one hundred years after John Adams' gallant attempt in Somerset, a new base-line was measured on Hounslow Heath. A map that would have satisfied Robert Hooke was begun.

THE DISCOVERY OF A NEW REEF NEAR ATTU ISLAND

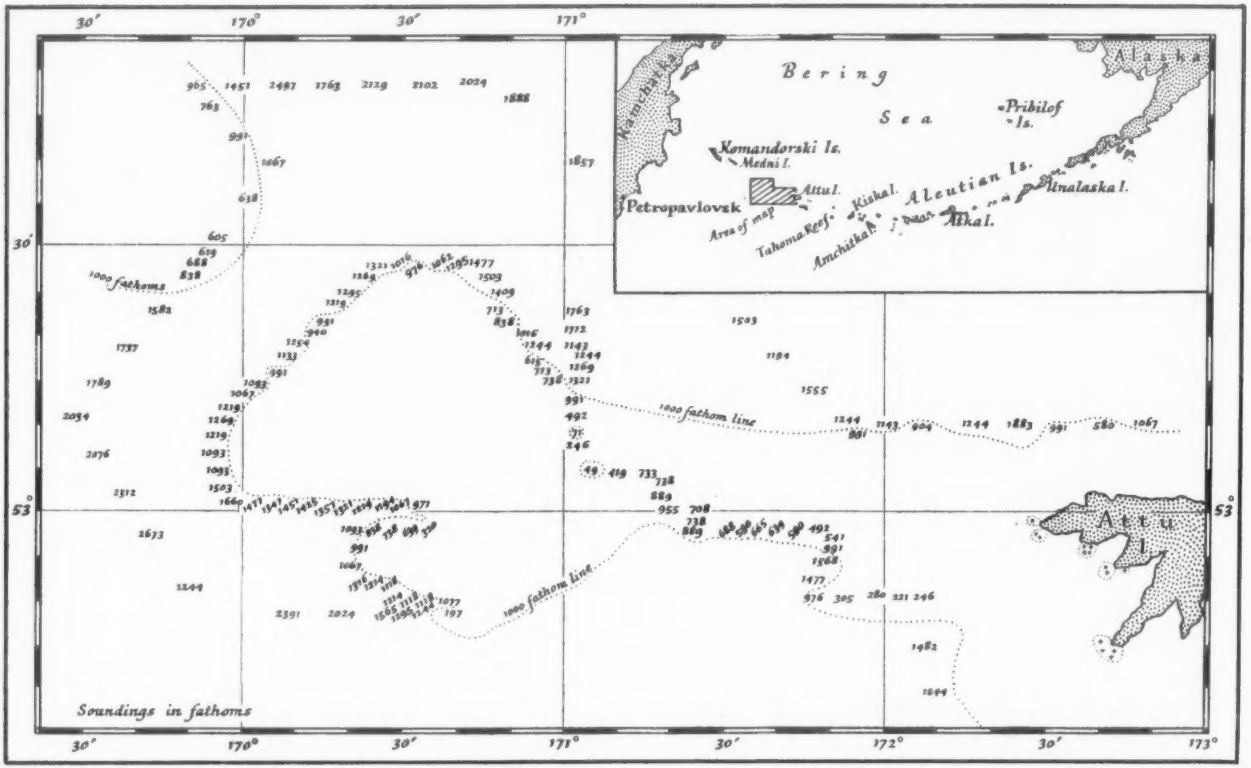
ISOBEL W. HUTCHISON

THE Aleutian Islands were first seen by Lieutenant Alexei Chirikov, commander of the *St. Paul* (companion ship of Vitus Bering's ill-fated *St. Peter*), and the following extract from his log is the first record of their discovery by white men: "*Sept. 4th* 1741. Latitude by observation 52° 23′ from Vaua, longitude 21° 10′ rhumb S 88° 19′ E, distance 770 knots. At the beginning of the seventh hour in the morning we sighted land ahead of us and a little to the left, but owing to the mist we could not observe it carefully. At noon the land which we sighted at the seventh hour appears now N.E. by N. 40 knots, N. by E. ¼ E. 30 knots; mountains (not very high) in N.N.W. 25 knots; high land, on which there are several high peaks, in N.N.W. ¾ W. 25 knots; a large, round snow-covered volcano N.W. by N. ¾ W.; the land ends W. by N. ¾ W. distant about 50 knots. Sailed past a dead whale on which were many sea-birds called fulmars." The "high peaks" referred to have been identified as the group now picturesquely named the "Islands of the Four Mountains." These are still, like the other islands of the Aleutian chain, actively volcanic on occasion.

Since the above entry in Lieutenant Chirikov's log, very little has been written about the Aleutian Islands, for these barren and now practically uninhabited spots are not "islands that like to be visited." They extend westward from the tip of the Kenai Peninsula of Alaska for about 1100 miles almost to Kamchatka, crossing the 180th meridian (though for purposes of convenience the date line in this region has been curved to include Attu, the most westerly of the islands under the jurisdiction of the United States of America).

The chain comprises some twenty larger islands, and hundreds of smaller rocks and islets, which are surrounded by seas acknowledged by their few navigators to be amongst the most dangerous known to mariners, for the waters which neighbour the islands are seamed with currents, shoals, tide-rips; are almost constantly fogbound; and are still very incompletely charted. With the passage of the centuries the Russian mariners' voyage of discovery in 1741, under Vitus Bering (a Jutland sailor in the service of the Czars) loses nothing of its amazing initiative. On the contrary, as we learn slowly and with difficulty more of these little-travelled waters, the successful attempt of these two small sailing vessels in crossing from Asia to America and back again in this region appears increasingly gallant. Even to-day, vessels are constantly wrecked in these waters, including at least two U.S. revenue cutters, one of which, the *Tahoma*, became a total wreck on an uncharted reef now known as Tahoma Reef, in the neighbourhood of Buldir Island in 1914.

During the summer of 1936 I was engaged in collecting botanical specimens on the Aleutian Islands for the British Museum herbarium. My base was on Unalaska, the largest of the islands, which is also the base of the Bering Sea Coast Guard Patrol. Finding it impossible to obtain any other transport to the further islands of the chain, of which Attu, only 580 statute miles from



Soundings indicating the position of the new reef west of Attu Island *Courtesy of the U.S. Coast Guard*

Petropavlovsk (the "Vaua" of Chirikov's log) is the most western, I was privileged to receive kind permission from the United States authorities at Washington to make a voyage as far as Attu on their coast guard cutter *Chelan*.

Though the charting of these waters is carried on by vessels of the U.S. Coast and Geodetic Survey, certain ships of the Coast Guard Patrol also assist in the work, and during the summer of 1935 the *Chelan* had already charted to the north of Kiska Island a reef of considerable interest geologically, as its curvature was in a different direction from the mountain ranges which enclose the Bering Sea. In 1936 the *Chelan* set out in mid-August from Unalaska for the western Aleutian Islands to continue her work of hydrographic survey in this region, seeking by her echo-sounding device (known in the U.S.A. as the Fathometer) for a continuation of this reef on the southern or Pacific side of the island chain.

Our cruise lasted three weeks, calls being made at the islands of Atka, Amchitka, Attu, and Kiska (the latter now a United States naval harbour closed to alien vessels and uninhabited—save for an occasional fox trapper—except for the rare visits of the coast guard cutter). These visits, though tantalizingly brief, for the anchor was sometimes dropped for only a few hours, resulted in the addition of some hundreds of specimens to the collection of plants gathered on Unalaska and the Pribilof Islands during the summer, some of the specimens from Attu being interesting Asiatic species not noted on the islands nearer to the American continent. Although during her hydrographic survey the *Chelan* found no indication to the south of the Aleutians of the reef charted in 1935, on the night of August 24, when cruising west of Attu close to the international boundary between Russia and the United States, her fathometer without warning suddenly recorded shoal soundings of only 49 fathoms in depth. Though this submarine "Everest" was not again tapped (the *Chelan* retreating immediately from its dangerous neighbourhood) she remained in its vicinity all night, and next morning her navigators set about defining the new reef so unexpectedly revealed. Up to that time, soundings of great depth had been recorded, for the so-called "Aleutian Trough" is one of the deepest pits of the sea, over 4000 fathoms deep in places, and was found by the *Chelan* in 1936 to lie much closer to the islands than had been previously supposed (a condition giving rise to great instability in the earth's crust). The new reef defined by the *Chelan's* navigators in 1936 is in places not more than 200 fathoms in depth. It apparently extends across the international boundary towards the Komandorski Islands, and is in shape not unlike a mailed fist which is met by the nose of another reef extending to meet it from the Medni (Copper) Island in Russian waters.

This unexpected discovery (for a deep trench has previously been supposed to sunder the two islands in this region, and is so marked on hydrographic charts) is of interest to the archaeologist as well as to the geographer, for certain scientists, opposed to the assumption that America's first inhabitants may have reached that continent from Asia across the Aleutian bridge (as well as by the islands of the Bering Strait) have cited the depth supposed to sunder Attu from the Komandorski Islands in proof of their theory of an American origin for primitive man in Alaska. However this may be (and Dr. Hrdlička, who is at present making archaeological investigations on these

islands on behalf of the U.S. National Museum, stated in his report for 1936 that conditions there were "still too complex to permit of any prompt and definite conclusions") the *Chelan's* discovery of this reef west of Attu in 1936 provides the last submarine link in the chain which binds Asia to America in this region, proving it to extend continuously from the one continent to the other between Alaska and Kamchatka, enclosing the Bering Sea on all sides in a shallow basin.

The map of the new reef discovered by the *Chelan* in 1936 and defined by Captain Kielhorn of the *Chelan* and his navigating officer, Lieutenant J. A. Glynn, is based on a chart placed at my disposal by the courtesy of Captain Kielhorn and the U.S. Coast Guard.

DISCUSSION

[*This Discussion followed Miss Hutchison's paper on "Plant-hunting in the Aleutian and Pribilof Islands," given to the Society on* 3 *May* 1937.]

Before the paper the PRESIDENT (Professor HENRY BALFOUR) said: To those of you who have already seen her extremely beautiful and interesting films Miss Hutchison requires no introduction from me. To others who were not so fortunate I will mention that she is a botanist who, for the purpose of collecting plants for the British Museum, made a somewhat adventurous journey into a part of the world little visited by British travellers. She is going to tell us about that extraordinarily interesting chain of islands which extends like a sagging necklace, as it were, across the Bering Sea and unites the Old World with the New in a rather remarkable manner. Such a chain as that, affording a continuous link between two large geographical areas, must necessarily be of great interest, and Miss Hutchison's botanical collection, when it has been fully worked out scientifically, will probably bring out most strongly one of the interesting points in connection with that area. Miss Hutchison is also going to tell us something about the Pribilof islands which lie slightly north of the Aleutian islands, and in that connection the main interest will be zoological rather than botanical. At the end of her lecture she is going to show a film taken by herself in the Pribilof islands which will give some vivid idea of the life of those extremely interesting animals, the fur seals, of the region.

I am not going to waste your time by talking longer, but with this brief preamble I will ask Miss Hutchison to be kind enough to deliver her lecture.

Miss Hutchison then gave her paper, a portion of which is reproduced above, and a discussion followed.

The PRESIDENT: Miss Hutchison in the course of her remarks has referred more than once to the courtesy and help she received from the American Navy. We are fortunately honoured to-night by the presence of the American Naval Attaché, and perhaps he will be so kind as to address us.

The AMERICAN NAVAL ATTACHÉ: I am very glad that I am in London to-night, for I have learned many delightful things about an interesting and remote part of my own country. Because I am a naval officer I much appreciate all the good things that have been said about the Coastguard Service of the United States. I think that the debt of the Coastguards is equally great to Miss Hutchison, because the presence of even one lady, "who goes about the world picking flowers," is likely to do much to brighten life aboard a small ship in remote parts.

Russian church, Unalaska

False Pass and salmon cannery, Aleutian Islands

Kagamilan Island: site of mortuary cave discovered by Dr. Hrdlička in 1936

By courtesy of U.S. Coast Guard

Bog cotton on Kodiak Island

Elymus arenarius used for basket weaving, Dutch Harbour

Epilobium angustifolium, Unalaska

The Aleutian islands, from the point of view of the United States and those of us interested in military and naval affairs, are interesting as a group which is strategically of great potential value, because of their being a bridge to Asia. On the other hand, the climate is not as salubrious as perhaps the pictures we have seen would indicate. There are few spots in the world of such potential strategic value from the point of view of the United States, which are so impossible to operate in with naval forces. What the development of aircraft may mean to this area, from the military point of view, lies in the future. It is an interesting subject for speculation.

I would like to thank Miss Hutchison for giving me the opportunity of enjoying an instructive and most interesting lecture.

The PRESIDENT: Mr. Wilmott, one of the botanists at the British Museum, who is engaged in working up the material brought back by Miss Hutchison, is with us. I hope he will come and add a word or two.

Mr. A. J. WILMOTT: I am very pleased to be here to-night to listen to Miss Hutchison's most charming and entertaining account of her journey, especially as we now have at the British Museum an excellent collection of specimens made by her. They will take some time to work out, but I am sure there must be a great deal of interest among them. My own interest in the collection—because I work primarily on British and European plants—is that one of those curious British plants which has an American distribution is the orchid which Miss Hutchison told us about, *Spiranthes Romanyoffiana*, and which, not content with being an American orchid, was originally described from right over the other side of the world, in Unalaska. About a century ago Chamisso and Schlechtendal worked out a collection from those parts, and many of the species were then new to science, so that the collection from Unalaska is of particular interest as coming from the type area for a number of species. So far as I know this is the first collection the Museum has had from these islands, and I am sure it will prove of very great interest.

The PRESIDENT: If no one else would like to comment upon this interesting communication I have only to bring to a close a most entertaining evening. When all the botanical and other scientific data have been worked out, this chain of islands must prove of very high interest indeed. Extending in the form of a more or less continuous chain between the two huge land masses of Asia and America one would expect that there would be Asiatic connections in the flora and fauna at the west end and more strictly American connections at the eastern end, with intermediate forms, possibly, towards the centre. I do not know how far that is so, but it will be an interesting matter to work out as a problem of possible continuity between the Old and the New World, from a faunistic and floristic point of view.

Miss Hutchison touched upon the question of the native population. Unfortunately she has had to inform us that the Aleuts are a dying race. They have now become reduced to a very small number indeed, and I suppose that at least half are of mixed blood, which renders the ethnology of the area somewhat disappointing and difficult to diagnose. In a general way the Aleuts are closely related, physically and linguistically, to the Eskimo, and at the same time there must have been considerable influence from the Asiatic side, so that even in the ethnology one would expect to find a meeting point of the east and the west. Miss Hutchison mentioned that the Aleutian islands with their, in former days, possibly even more continuous distribution may have been one of those great migration routes which helped to people America from Asia.

On the archaeological side Dr. Hrdlička, to whom Miss Hutchison referred, has been doing remarkable work in the more easterly portion of the area and

has discovered not only mummies but many early works of art. He has moreover discovered a whole school of art, distinct from the general run of western Eskimo art and reaching a very high stage of development. That art is now a thing of the past, but the discovery of it alone renders the interest in the former inhabitants of the area of striking consequence.

It only remains for me to offer the thanks of the meeting to Miss, or may I say "Admiral," Hutchison for an extraordinarily interesting, lucid and graphic lecture.

THE NEBIEWALE CALDERA, GOLD COAST

HERBERT P. T. ROHLEDER

AT the beginning of July, when trekking through the north-west section of the Northern Territories, the author unexpectedly found a hitherto unrecorded caldera-like depression, which appears to be of a pseudo- or cryptovolcanic nature. As it was outside of the actual sphere of his scientific work, time was limited, and the observations and the accompanying map are based on several traverses across and around the caldera. The following remarks are necessarily of a rather sketchy nature, but it is hoped that the Gold Coast Geological Survey will fully investigate the nature of this interesting phenomenon in the near future.

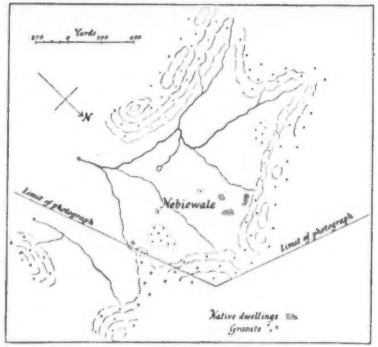
The caldera is situated within a hitherto little-known part of the Lawra Tumu district, approximately under 10° 35′ N. and 1° 40′ W. The native settlement of Nebiewale and surrounding farms are situated within the basin, and a considerable part consists to-day of cultivated land.

The depression shows a diameter of roughly $1\frac{1}{2}$ miles in an east–western direction and about 1 mile north–south. Thus it is not circular, but elongated; surrounded by a continuous rim of medium-sized hills in the west, north, and east, it is open towards the south and south-east. All the streams drain into the centre of the depression, forming a small pond which supplies the native dwellings with water. According to statements of the native population the bottom of the depression during the rainy season is to a great extent filled with water, and when the latter has reached a certain level it flows off through the southern gap. The irregular shape of the caldera, in particular the opening towards the south and south-east, and also the valleys in the west, are due to erosion. As everywhere in the Northern Territories of the Gold Coast, streams and small rivers carry water merely during the rainy season (May to September), but although erosion is limited to this period, the degree is comparatively high, due to the steep walls of the caldera rim.

Towards the south-west the remnants of a range of low hills are notable in the distance, approximately 3 miles away. Whether the latter have any connection with the origin of the caldera is doubtful and could not be decided during this short investigation.

The vegetation of the caldera bottom is scanty, if anything even scarcer than the typical savannah country of the neighbourhood. This may be partly due to native farms and gardens.

The most interesting problem is the origin of this depression. The bottom,



The Nebiewale caldera

rim, and the whole surrounding country are built up of crystalline masses, mostly granite. The latter contains streaks of more basic material and irregular-shaped slabs of metamorphic rocks. These inclusions consist of more or less assimilated products of the sedimentary and metamorphic rocks underlying the granite, shales, schists and associated rocks of the Birrimian System of Precambrian age. This however is nothing exceptional, as these features are typical of the whole section of the Northern Territories as far south as Bole and Grupe. What appear to be fracture zones are in truth highly weathered pegmatite veins; quartz veins are also not uncommon. Outcrops of granite, though scarcer in the caldera bottom, cannot be distinguished petrographically from those on the caldera rim and beyond. Even the jointing phenomenon, due to cooling processes of the granite mass, is clearly visible on the rim and bottom, and thus cannot have been affected seriously by any later orogenetic movements. In accordance with this, pegmatite and quartz-veins have not been dislocated to any higher degree than in the surrounding country. No volcanic rocks of later age could be found on the bottom of the caldera, or in the walls or neighbourhood. Thus there are no geological features which would explain the origin of this basin, and therefore the same arguments put forward for the Gold Coast's hitherto unique cryptovolcanic caldera, Lake Bosumtwi[1] in Ashanti, seem fully applicable to it.

Isolated, steep-sided depressions in the earth's crust, unassociated with volcanic matter, have within recent years frequently been explained by the impact of meteorites. Thus Maclaren[2] tried to explain the origin of Lake Bosumtwi in this manner, but his theory has been fully disproved by later geological investigations,[3] mainly by the important finds of young volcanic tuffs. In the case of the Nebiewale caldera there is not the slightest reason to assume such origin. Though the size would seem more normal than in the case of Bosumtwi, the longitudinal shape speaks against it and, in particular, the obvious absence both of meteoric material and brecciation of country rock, which should naturally result from a meteorite impact.

In the case of Lake Bosumtwi occurrences of explosive material, dacitic tuffs, have been established beyond doubt, though the problem of the origin of the caldera proper has so far not been solved. As far as the Nebiewale caldera is concerned, any explosive activity can be ruled out. Apart from the absence of volcanic tuff, brecciation or any signs of young pneumatolytic action, it is inconceivable that the original jointing of the granite on the rim and even in the caldera bottom could have remained intact.

Dolina origin is out of the question owing to the insolubility of the igneous rocks. As early as 1916 however the late Sir Albert Kitson[4] suggested that the depression of Lake Bosumtwi was due to subsidence, and later[5] "that it

[1] Lake Bosumtwi, south-east of Kumasi, the capital of Ashanti, lies approximately 250 miles south of Nebiewale.

[2] Maclaren, M., "Lake Bosumtwi, Ashanti," *Geogr. J.* 78 (1931) 270–6.

[3] Rohleder, H. P. T., "Lake Bosumtwi, Ashanti," *Geogr. J.* 87 (1936) 51–65. Junner, N. R., "The geology of the Bosumtwi Caldera and surrounding country," *Gold Coast Geological Survey Bulletin*, No. 8, 1937.

[4] Kitson, A. E., "The Gold Coast: some considerations of its structure, people and natural history," *Geogr. J.* 48 (1916) 369–92.

[5] Kitson, A. E., Annual Report of the Gold Coast Geological Survey, 1919, p. 13.

was not of volcanic origin, but probably due to two pairs of parallel faults crossing each other and the foundering of the enclosed block of country."

Though volcanic matter definitely reached the surface in the case of Lake Bosumtwi, the author tends to accept Sir Albert Kitson's theory in principle as far as the Nebiewale caldera is concerned. Two facts seem beyond dispute: that no volcanic material reached the surface; that the circular depression is due to sinking. The only possible explanation appears to be a process of sinking, due to a hollow in depth or due to deep-seated volcanic activity, which indeed would be better called plutonic activity. If this is the case the Nebiewale depression represents the "ultra-cryptovolcanic caldera"; so far the cryptovolcanic caldera has been regarded as a feature of surface volcanism, either entirely due to a phreatic explosion, or to a process of sinking following some explosive surface activity, but with no, or little, visible products. In this case we would have a caldera due to volcanic activity, which never even reached the surface: a cryptoplutonic or intrusive caldera, as compared with the cryptovolcanic or extrusive caldera.

In this connection it might be stated that for several years the author has suspected South Germany's famous Steinheim Basin to be of different origin from the Ries von Nördlingen,[1] and the new discovery at Nebiewale supports his theory. The analogy between the two occurrences of the South German Tafeljura (Ries von Nördlingen and Steinheim Basin) and the two occurrences in the Gold Coast (Lake Bosumtwi and Nebiewale) is indeed striking. Not only do the ratios compare in size, but in both cases the large caldera shows embryonic surface activity, the small caldera none. At Steinheim there are definite signs of brecciation (*Vergriesung*), hitherto interpreted by all German geologists as tokens of some mysterious kind of explosive activity, though the actual mechanism has never been explained. The bottom of the Steinheim caldera has undoubtedly been dislocated to a very great extent. At Nebiewale however there are no signs of brecciation; on the contrary, there is evidence to show that the caldera bottom has scarcely been affected. Thus there appears to be a certain difference in degree: whereas the Steinheim Basin was shattered during the act of sinking, the Nebiewale caldera apparently sank *en bloc*, along a curving line of weakness, which probably coincides roughly with the caldera edge.

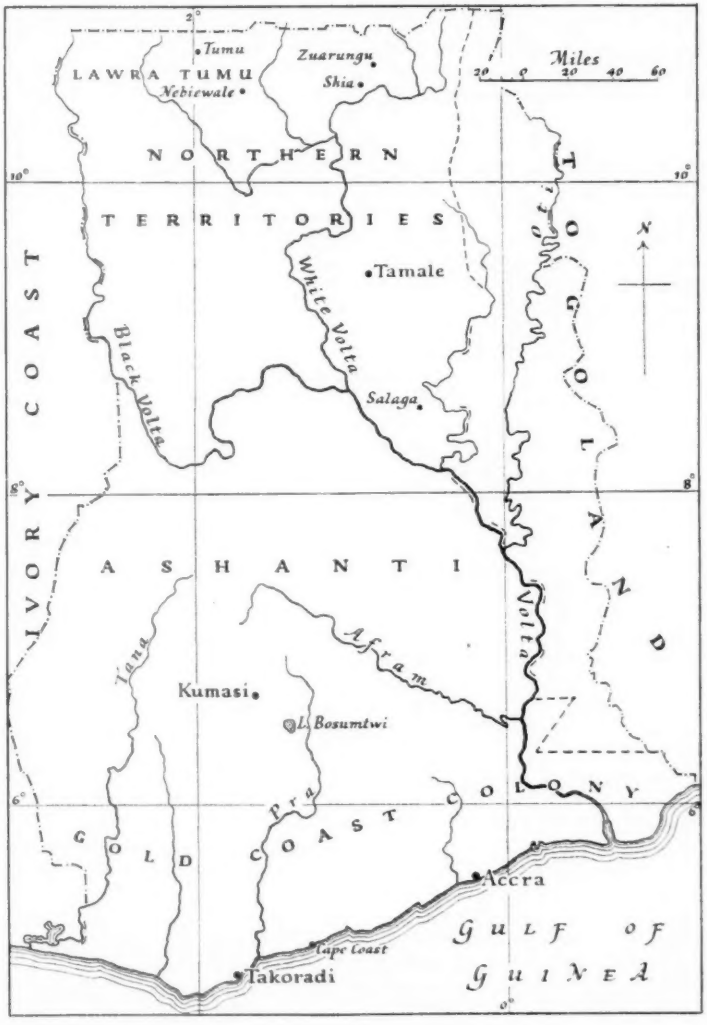
These conditions are to a great extent comparable with the Glen Coe cauldron in Scotland. Here the sunken area, 9 miles by 5, dates from the Lower Red Sandstone of Devonian age, and thus naturally does not find expression as a hollow in the topography to-day. The sunken area is bounded by a curving dislocation, at its initiation probably a continuous one, though its outcrops are now interrupted for about 4 miles by a northward extrusion of the Cruachan granite.[2] In the heart of an igneous complex, in close con-

[1] Seeking for a new explanation of the Steinheim Basin the author had discussed the possibility of meteoric origin, though he admits that there is just as little evidence in its favour as for the general German hypothesis of origin. See Rohleder, H. P. T., "Meteor crater—saltpan—Steinheim Basin," *Geological Magazine*, 1933.

[2] "The geology of Ben Nevis and Glen Coe," *Memoirs of the Geological Survey of Scotland*, No. 53, 1916. C. T. Clough, H. B. Maufe, and E. B. Bailey, "The Cauldron—subsidence of Glen Coe and the associated igneous phenomena," *Quarterly Journ. Geol. Soc.*, 1909.

nection with intrusive processes, the Glen Coe cauldron must also be regarded as a cryptoplutonic, rather than as a cryptovolcanic, caldera.

In conclusion the author desires to draw attention to the fact that Junner reports having found quartz breccias and hornstone breccias of the Bosumtwi type near Shia (or Sia), south-east of Zuarungu. The latter locality is approximately on the same latitude as Nebiewale, though some 55 miles east. Having found this analogon to Lake Bosumtwi in a district hitherto unassociated with any young volcanic or plutonic processes, it seems probable that further investigation might reveal other calderas of the Bosumtwi–Nebiewale type.



THE FORESTS OF WEST AFRICA AND THE SAHARA; a study of modern conditions. By E. P. STEBBING. *London and Edinburgh: W. and R. Chambers*, 1937. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* viii+245 *pages; illustrations and sketch-maps.* 15*s*

THE greater part of Professor Stebbing's book is concerned with a comparative study of the organization and activities of the government Forest Departments in the French and British Protectorates in West Africa. The discussion of these matters is highly informative, but the main geographical interest of the book lies in the earlier chapters which contain the author's observations upon the forest types of West Africa and the alleged influence of the Sahara to the north.

The natural forest covering of West Africa is commonly spoken of as "bush," and in it, except in high forest with a continuous canopy, grass is a constant accessory, filling all the interstices between the trees, and annually burnt in the dry season. Three main types of forest occur, Rain or Evergreen Forest, Mixed Deciduous, and Savannah (pp. 5, 40), the last misnamed according to the author (p. 7). The high evergreen and moist deciduous forests, containing valuable timber trees, occur in the wetter regions near the coast, while the interior is largely covered with dry deciduous forest of varying height and composition. Over extensive areas these primeval forests have now been replaced by the so-called savannah forests, the degraded mixed deciduous successors of all the other types. The degradation is due mainly to the action of man, who fires the grass to facilitate hunting and grazing and clears the bush for agriculture of the type known as "shifting cultivation." Natural regeneration is slow and Professor Stebbing recommends that in the southern forests the process should be hastened by replanting, prevention of firing, and restriction of shifting cultivation. In the interior, where there are large areas of uninhabited bush, the most urgent measure is the prevention of the annual firing.

In Nigeria, which extends farther inland than any of the other British possessions in West Africa, the author believes that the scattered trees which occur in the thorn bush and grassland in the extreme northern part of the Protectorate (photos, pp. 8, 9, 15) indicate that even this distant region was formerly covered with lofty forest, which has been degraded and almost destroyed by the action of man and the influence of the desert to the north (p. 15). Here he recommends the improvement of impoverished bush, the reservation and rejuvenation of extensive tracts of existing forest, the prevention of firing, and the restriction of indiscriminate farming and grazing.

It is evident from the author's treatment that he is of opinion that the whole region, including the northernmost parts of Nigeria, still possesses sufficient humidity and rainfall for the reconstitution of the forests, if necessary (p. 19). He considers that such reconstitution is necessary and even urgent along the northern frontier of Nigeria, to raise up barriers against the advancing desert, his investigations in this region having "resulted in a settled conviction, that, governing all action in this matter, is the threat of the Sahara " (p. 232).

Since his tour of the Protectorates in 1934 and his return home by the French Transsaharienne Motor Service, the author has been impressed by the menace of the Sahara (*Geogr. J.* 86 (1935) 506: *J.A.S.* Extra Supplement, 1937). He is convinced that the desert is on the move. Already it has passed the 15th parallel. The fertile plains of Hausaland will soon be in its grip. Within fifty years, or less if nothing is done, Kano, the capital, may be overwhelmed (p. 10).

This book sums up our present knowledge of the Sahara. The author accepts the general belief that there was once a pluvial period in the desert, perhaps

contemporaneous with the Ice Age and early man. He adopts the French view of its subsequent history according to which there has been a slow progressive desiccation of the Sahara and its borderlands which is continuing with greater intensity at the present day. According to French explorers the belt of country on the southern margin of the desert is rapidly deteriorating. The wells are failing, the herbage is withering, the pastures are being sanded over, and the scanty inhabitants are being forced to migrate. It would have been interesting to know what the French are doing to mitigate the peril.

What concerns us more nearly is that Professor Stebbing, from his own observations at Geidam and Katsina within British Nigeria, is of opinion that similar conditions are developing along the Nigerian frontier, and that at various points the country is already losing its fertility under the influence of the approaching desert. Fortunately it is unnecessary to discuss this question. During the present year, as noted on p. 236, an Anglo-French Commission has been studying existing conditions on both sides of the Nigerian frontier and the publication of the Commission's report is being awaited with great interest and no little anxiety. If the Sahara is advancing, who or what can stem it?

But when it is confidently asserted that the sword of Damocles is already suspended over the fertile plains of Hausaland, that if nothing is done "the end is obvious, the total annihilation of vegetation and the disappearance of man and beast from the overwhelmed locality" (p. 16), one proceeds to examine the evidence upon which so pessimistic an outlook is based. It is important to note therefore that, while the author repeatedly speaks of "encroaching sand and desiccation," of "sand drift" and "sand deposits," of "sand invasion" and "sand penetration" of Hausaland, nowhere in his book does he make mention of seeing the sand anywhere in motion or of encountering a sandstorm anywhere on his way. Nowhere did he meet a real "live" sand dune, or even stumble upon a dead one, to the south of the international frontier. His attitude towards wells and underground water is particularly ingenuous. Instead of providing it, he asks for evidence to support his view that the water supply is failing. "The mere presence of wells . . . affords . . . food for thought and observations. What is the depth of the water table in this region? Is it becoming lowered? What was the depth 30 years ago?" (p. 36).

Then there is the *harmattan*, a dust haze or dry fog which may persist for days on end in the dry season. Like a London fog it varies in density and descends upon the land in the absence of wind. The dust is believed to be carried from the Sahara in the upper air, but wind dissipates it at the surface. It is an impalpable powder that whitens the hair and beard, hurts the eyes, nose, and lips, and clogs the pores of the skin. Professor Stebbing could never have experienced it. He calls it a "sand-bearing, desiccating wind" (p. 154), "carrying sand from the north-east and spreading it far to the south in the hot dry weeks" (p. 15). He asks rhetorically "Has the amount of sand deposited annually . . . by the harmattan on districts in Central Nigeria . . . ever been ascertained?" (p. 17). The answer is in the negative, because there is nothing but a film of dust to measure.

Thus if "proof of the steady advance of the Sahara exists" (p. 47) on the southern side of the Nigerian frontier—tangible proof, and not mere speculation—it is nowhere contained in Professor Stebbing's book. Also conspicuously missing is any reference to the existing climatic régime in West Africa, and more particularly in Nigeria, where the alternation of wet and dry seasons is of a monsoon type and might have been usefully compared with similar conditions in India. There is for example the same danger of the partial failure of the monsoon. In any year or in a succession of years the rain-bearing winds from

the south-west may fall short of their usual inland extension. Such was the case in parts of the northern provinces in the thirsty years in the beginning of the century. Recently there has been a marked recovery and rivers which have been dry since the British occupation have again begun to flow. Professor Stebbing makes no mention of the possibility of attracting or extending the rainy winds by increasing the area of the forests, a favourite theme of sylviculturists. Nor does he remind the casual visitor who tours the country in the dry season in February and March that, later on, in July and August, there is too much rain and surface water for comfortable and expeditious travelling.

Likewise unnoticed in this book is another theory which provides a ray of hope for the millions who are "living on the edge of the desert" (p. 16). More than a quarter of a century ago the reviewer pointed out, in 'The geology and geography of Northern Nigeria,' that there exists in Nigeria evidence of a geographical nature which indicates that while in the immediate past the desert unquestionably extended into the northern provinces, the present régime of periodic rains represents a return to more humid conditions. This theory offers a means of escape from the predictions of evil. The evidence upon which it is based has never been refuted, but it has been persistently ignored by the desiccationists and only of recent years has it received some tardy recognition in France (Gautier, E. F., 'L'Afrique Noire Occidentale,' 1935).

It follows from this theory that the dry deciduous forests of the northern districts, as well as the scrub and grassland with scattered trees, are not to be regarded as degenerate and "on the downward grade to pure desert" (p. 11), but rather as struggling to assert themselves in an unfavourable environment. Even the baobab with its thick fleshy stem is adapted to semi-arid conditions. The vegetation has already succeeded in clothing the former desert on the return of more genial conditions, and, if left to itself, it would continue so to do. It may be poor in species of economic value, but even when much abused by men and animals, its natural resilience is great. Whoever has seen the charred bones of the Nigerian bush starting into life at the approach of the rains cannot fail to be convinced of its latent virility. Annually, the whole appearance of the country changes. Where it is possible to see for miles across the farmland in the dry season and for long distances through the bush, one can only see for yards in the rains. The deep sandy soil is amazingly fertile and the vegetation of extraordinary luxuriance. Nowhere in his book does Professor Stebbing mention this annual transformation scene. His descriptions and his photographs of the northern parts are all of dry season conditions.

Although one may cavil at his omissions and at his attitude towards the Sahara, it is obvious that the author has done a service to West Africa in calling attention to the dangers of overfarming, overgrazing, and overstocking, and of irresponsible firing, felling, and hacking of the forests. By these means even the best land may be degraded to barren waste. The necessity of promoting remedial measures of the type so well described and illustrated in the later chapters of this book is no doubt officially recognized.

But the fate of the West African Protectorates is by no means sealed. With wisdom and forethought their future may well be assured, and if the ghost of the Sahara can be securely laid, hope will revive over the whole of the Western Sudan. The Nigerian portion of it is a fair and pleasant land. Already for 80 miles to the east of Kano the unproductive forest has been replaced by parkland and cultivation (p. 11), and there is every reason to believe that, freed from the spell of impending doom, the fertile plains of Hausaland will continue to flourish and their inhabitants to prosper without fear of any disastrous climatic change.

J. D. F.

REVIEWS

EUROPE

THE NATURAL HISTORY OF THE HITCHIN REGION. Edited by REGINALD L. HINE. Hitchin and District Regional Survey Association, 1934. 10×6½ *inches;* 256 *pages; illustrations and maps.* 7*s* 6*d*

This is a well-produced work dealing with the natural history of the diversified countryside within ten miles of Hitchin. H. L. Hine contributes a short account of some of the leading naturalists and antiquaries of Hertfordshire. This is followed by an admirable chapter on the geology of the district by E. F. D. Bloom and a brief note on the meteorological records by Miss G. B. Howells. J. E. Little contributes the botanical chapter, while the zoological sections which make up the greater part of the book are the work of Ray Palmer, A. H. Foster, and F. W. Edwards. A short account of the archaeology of the district by W. H. Lane concludes the volume.

The work may be regarded as a companion or sequel to Hine's two volumes on 'The history of Hitchin.' It attains high standards of scholarship in respect of both matter and presentation, and though works of this kind are to some extent unfashionable to-day, it constitutes a worthy addition to the list of regional natural histories written and prized by former generations. It has in addition the merit, not possessed by all books of its type, of being essentially readable. The illustrations call for special comment. They include a large number of good photographs and reproductions of water-colour drawings. A folding-map of the district and a transect chart of the country are included with the volume.

It will, we think, be interpreted in no sense as a criticism if we remark that a further task still challenges the able and enthusiastic band of workers at Hitchin. Now that the data of both the human and the natural history have been assembled, it will be possible to attempt a truly geographical synthesis which traces the development of the region stage by stage: a human geography. It is true that the Hitchin area as here defined is not strictly a "region." Yet it affords good material for such a study, lying athwart one of the major regional boundaries of Britain, and sufficiently far from London to escape in large part the monotonous red rash of "development." Geographers would welcome such a study and will hope to see it completed, but meanwhile they can be grateful for the thorough and careful groundwork of observation recorded in this volume. S. W. W.

MODERN SCOTLAND, AS SEEN BY AN ENGLISHWOMAN. By CICELY HAMILTON. *London: J. M. Dent & Sons,* 1937. 7½×4½ *inches;* x+240 *pages; illustrations.* 7*s* 6*d*

This book is avowedly an attempt by an Englishwoman to give to the "uninformed English reader" a general account of certain aspects of Scottish life, and more especially those relating to the main economic and social problems which at present confront the Scottish people. The problems are clearly stated, but few suggestions are made as to their solution. The subjects to which most attention is given may be grouped under three headings: the Scottish National Party, Irish immigration, and the depopulation of the Highlands. With regard to the first of these we doubt whether Miss Hamilton is correct in saying "that material grievance is for the most part but a secondary cause of the demand for a Parliament sitting in Edinburgh, and that its primary cause

is the instinctive urge towards attainment of unity which is stirring in more races than the Scottish." Even the small amount of support which the Scottish National Party receives at present is probably due to the economic loss sustained by the southward trend of industry, and it is difficult to see how this could be repaired by a Scottish Parliament. In the two chapters which Miss Hamilton devotes to Irish immigration she touches upon some of the problems which arise from it, but gives little indication of its extent. It is conceivable however that under certain circumstances it might become a more potent factor in the development of a Scottish National Party than any other which she has mentioned. With regard to the Highlands the author has little new to add. She quotes various opinions but she appears to recognize that the more vigorous element in the population will not accept the conditions of life that their forefathers did; which is after all the truth. Other chapters in this book deal with such subjects as "the Kirk," Edinburgh and Glasgow, and the Tay and the Tweed; they are interesting and readable if not very profound. But, surely, very few, whether Scots or "uninformed" English, will agree with the author when she says that it would have been "infinitely righter" if the Scottish National War Memorial had been built, not on the Castle rock but on some bare open field. J. McF.

CLASSIFICAZIONI ED INDICI DEL CLIMA IN RAPPORTO ALLA vegetazione forestale italiana. By ALESSANDRO DE PHILIPPIS. (From "Nuovo Giornale Botanico Italiana" N.S. XLIV, 1937.) (Pubblicazione fuori serie . . . Comitato Nazionale per la Geografia.) *Firenze: Mariano Ricci (for "R. Stazione Sperimentale di Selvicoltura")*, 1937. 10×6½ *inches;* 170 *pages; maps and diagrams*

Many will be surprised to learn that at least 140 published papers and books have appeared bearing upon the climatic control of the vegetation. Such is the extensive bibliography contained in this interesting inquiry on the relations of climate to the woodlands of Italy. The author begins with a clear summary of the progressive refinement in the classification of climates, stating the various indices proposed—thermal and pluvial, separately and in combination. He then reviews historically the zoning of natural vegetation in Italy and adopts the following main divisions and altitudes: (1) evergreen macchia and hard-leafed forest, up to 200–400 m. (North Apennines) and 600–800 (South Apennines and islands); (2) winter-resting broadleafed forest, from 200–800 m. to 1000–1500 m. (Alps). The climatic sub-types of de Martonne and of Köppen are examined in so far as they relate to Italy, then attention is given to the classifications of A. Pavari (1916) and of K. Rubner (1934), both being thermal in character and designed with special reference to the demands of forests. Pavari's system, which relates to Italy and is based upon mean temperatures, after full discussion is summarized in a diagram showing zones and overlaps for the associations: Lauretum, Castanetum, Fagetum, Picetum and Alpinetum. Rubner's method depends upon the number of days with temperature above 10° C. and, for its subdivisions, upon the range of temperature, thus introducing the element of relative continentality. The relations of the zones as determined by the two systems are brought out in two diagrams; the results do not differ greatly but the data necessary for Rubner's method are more infrequent. When rainfall data are added to Pavari's the resulting climatic regions are found to correspond well to the major divisions of Italian forests.

The author proceeds to deal with the synthetic types of index, involving heat and moisture, selecting for examination those of Lang (rainfall factor), de Martonne (index of aridity), Emberger (pluvio-thermal quotient), Amann

(hygro-thermal), Kotilainen (oceanicity index), and Gams (hygric continentality index). Space does not permit full reference to the discussion of these, which occupies forty pages. The results of each method, plotted for Italy, are compared by word and diagram with Pavari's zones; and in the case of Pavari, Lang, Emberger, and Gams the reader is further enabled to compare the maps prepared by the author. The synthetic indices all refer essentially to atmospheric humidity and their values run in general parallel to those of precipitation. They are held to be preferable to the latter, but in the absence of adequate direct readings from hygrometer and evaporimeter the author is unable to decide which of them is best suited to Italian conditions. However since the ratios of Amann, Gams and Kotilainen turn out to give variable results, and Emberger's method is rather laborious, he prefers to use Lang's and de Martonne's simple ratios. In mountainous regions however and in default of thermal data Gams's graphic index, involving data only of altitude and precipitation, may be used, remembering that the resulting series of values cannot be compared if they refer to regions which, though of similar altitude, are subject to different thermal regimens. The author considers that future research must aim at obtaining exact knowledge of the responses of various plant species to the climatic elements during the different phases of their vegetative activity.

The maps of Italy (Gams's method for northern half only) referred to are well printed in colour on the scale 1/2·5 M. Like the laborious examinations in the text they are based upon data from 471 selected stations. The monograph includes two valuable tables referring to these stations. The first gives all the relevant meteorological figures, while the second shows the climatic value of every place according to each of the seven climatic indices examined in detail. In addition there are useful notes of the natural and cultivated vegetation at all the stations. A. G. O.

SPANIEN IM UMBRUCH. Die räumlichen und geistigen Grundlagen der spanischen Wirren. By JOHANNES STOYE. (Macht und Erde. Edited by K. HAUSHOFER and U. CRÄMER. Heft 2.) *Leipzig: B. G. Teubner*, 1936. 8½×6 *inches; 68 pages; maps. M.*1.05

This is a brief summary of the influences controlling the course of Spanish history from earliest times down to 1936. The author begins with a consideration of the geography, racial history, and national characteristics of the Spanish people. A wide range of sources of varying reliability has been utilized, and the naïveté of some of the conclusions may be due to lack of first-hand knowledge of the country: Dr. Stoye states, for example, that the Catalan in his individualism may be considered as a Spanish prototype (p. 26). Current political formulas are occasionally dragged in to explain the obvious: it is difficult to grasp why *Volk und Raum* should solve the riddle of the partially undeveloped mineral resources of Spain for which *Boden und Mensch* can give no explanation (pp. 5–6). The Inquisition is dealt with at some length: Dr. Stoye has evidently accepted Llorente's estimate of the number of victims, although they were long ago shown to be greatly exaggerated. In tracing the political history of Spain the author is on surer ground. He is justly critical of the aims of those who have held, or struggled for, power. His attitude to the various revolutions is reasonable; and if he enlarges on the chaos for which the First Republic was responsible, he is mostly fair to the leaders of the Second. The present situation which he considers to be the legacy of an intellectual, un-Spanish revolution which naturally aborted, is seen chiefly in the light of a problem affecting the Mediterranean as a whole. He concludes with a few interesting pages on the recent development of Spanish relations with South America. J. P. H. M.

ATLAS DER FREIEN STADT DANZIG von NIKOLAUS CREUTZburg und anderen. *Danzig: Kommissionsverlag Danziger Verlagsgesellschaft*, 1936. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* $35+29$ *maps in colour. M.6*

The Free City of Danzig has provided the theme for a considerable amount of polemical literature, and it is important therefore to determine the objectivity of any new atlas. The germ of the work, according to the Preface, consisted of a map display, prepared by the Geographical Seminar of Danzig *Hochschule* for a meeting of German geographers in 1931. These original maps have been revised to incorporate statistics down to 1934, added to, and provided with introductory letterpress. It would appear that Professor Creutzberg's plan was to avoid throwing fuel on the revisionist controversy, for the material presented is somewhat selective. Several thorny economic questions have been touched but lightly; it may be fairly said that the work as a whole is innocent of *Geopolitik*.

The maps portray only the physical and economic geography of this little political entity, as well as the development and lay-out of the city itself. Beginning with maps of relief, geology and soils, the series proceeds through settlement from the prehistoric era to the modern, population distribution, land utilization, crops, the evolution of the city itself and the outport Nefahrwasser, to conclude with the direction and character of trade. The letterpress is as unprejudiced as the maps. Each collaborating cartographer writes a brief note on his contribution, and generally draws attention to the salient features, sometimes addressing himself also to the explanation of obscurities. Only the author of the trade maps touches the inflammable: he can hardly avoid demonstrating the hardship (barely mitigated by the Agreement of 1933) inflicted on the Free City by the deliberate diversion of traffic through Gdynia. But the wider problems of political geography are not considered. There is no study of the effect of political changes on the direction and character of trade, of the relationship of the port to the hinterland and above all no speculation on the future of this commercial focus. Any one studying these problems must look elsewhere, even for the German case. J. H. G. L.

MITTELBULGARIEN: das kulturgeographische Bild der Gegenwart. By JOHANNES F. GELLERT. (Neue Deutsche Forschungen. Abteilung: Historische und politische Geographie, Geopolitik. Edited by WALTHER VOGEL.) *Berlin: Junker und Dünnhaupt*, 1937. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* x+294 *pages; maps. M.15*

A series of geographical studies of Bulgaria by German specialists was inaugurated in 1925, largely at the instigation of the veteran geographer, Professor A. Penck. The co-operation of the Bulgarian authorities was assured, and the results of several years' work are now being published. Some of these studies have already been noticed, *e.g.* H. Wilhelmy's excellent volumes on "Hochbulgarien" (*Geogr. J.* 87 (1936) 156–8), and here is a somewhat similar treatment of "Mittelbulgarien."

The region in question is regarded as comprising the land between the High Balkans on the north and the Rhodope and Sakar Planina on the south. That is to say, it is drained by the upper course of the Maritsa and by the greater part of the Tunja, and consists largely of lowland basins, with the main exception of the Sredna Gora, sometimes known as the Anti-Balkans. Up to the present there has been no well-accepted geographical name for this area, and it is perhaps better known by the somewhat old-fashioned term of "Eastern Roumelia."

Dr. Gellert's morphological studies of this region have been published elsewhere, and the present work mainly deals with land utilization and the evolution

of the cultural landscape, including settlements (*e.g.* houses, villages, towns) and transport. The author's observations and investigations are reported in detail and the result is a very careful and excellent regional study which will be of great value to the specialist. At the same time, the author has constantly kept in mind the relationships of this area with the rest of the country and the work throws much light on conditions in the country as a whole.

The prevailing impression is the general backwardness of Bulgaria compared with Central or Western Europe; in fact the author seems to have some aversion to his subject on that account, but it is clear that a general process of "westernization" or "Europeanization" is taking place. For instance, the increase in motor transport, especially by motor-buses and light lorries, is noteworthy. On the other hand, the old open field system and compulsory rotation of crops (*Flurzwang*) is still the general rule, and the agrarian law of 1921 seems to have had little effect towards abolishing the strip system of land tenure, with its scattered holdings.

The book is illustrated by a series of maps and diagrams, some of which would have gained by being on a larger scale. It would be very interesting to see the original large-scale maps, if such exist, from which the land utilization diagram (Fig. 3) was compiled. The plans of the various towns afford considerable material for study, and so do the diagrams showing lines of transport. It was a happy thought, also, to print the diagram showing the character of the soils (loamy, sandy, etc.) on the same page as that showing soil-types (podsols, etc.).

It seems a pity that no room could be found for photographs or for an index, but in spite of these omissions and of a certain lack of warmth in the writing, the book is a very valuable contribution to the geographical literature on Bulgaria. Many readers will welcome the objectivity of the author's treatment, since dispassionate views in regard to South-Eastern Europe are somewhat rare.

M. R. M.

ATLAS OF THE LENINGRAD OBLAST AND KARELIAN A.S.S.R. With text and index bound separately. *Leningrad: Economic Geography Scientific Research Institute, Leningrad State University*, 1934. 18·5 × 15 *inches*. 200 *roubles*

A permanent commission has been established at Moscow for the production of a new World Atlas, which will presumably include a comprehensive series of maps of the geography of the Soviet Union as it is to-day. Meanwhile students have been very much at a loss for Russian cartographic material, and the Atlas of the Leningrad Region and Karelia is doubly welcome, both for its own content and for the promise which it holds out of the gradual regional mapping of the whole of the Union on a similar generous scale. From the point of view of technique this Atlas challenges comparison with the recent Atlases of Poland, of Czechoslovakia, and of certain regions of Germany, and save for a somewhat weak binding bears the comparison well. Like other recent national and state atlases, it aims at giving a comprehensive picture of physical, economic, and human distributions, and the sixty-five double-page plates include also innumerable small inset maps, diagrams, and graphs. The principal phenomena are mapped on a scale of 1 : 100,000, but in the accompanying handbook it is explained that since the data are far from complete, the maps of, for example, relief, geology (solid and drift), soils, and vegetation must be looked on as a first approximation only. Density of population is shown by the "patch" method, while agricultural distributions, based on data from comparatively small administrative divisions as units, are indicated by graded flat tints. As in the Atlas of Czechoslovakia, the dot method, so popular in this country and

in the United States, is rejected: no doubt for the reason that unless a very refined technique is possible, it gives misleading results. As the date of the Atlas indicates, the economic and human distributions are those which obtained at the end of the first Five Year Plan, and must already be on the way to obsolescence. It is indeed a characteristic of post-War statistics that "normals" have almost vanished, so that economic atlases can never be abreast of the times. A series of such atlases would of course be valuable historical documents, but the enormous cost of production makes a series at close intervals out of the question. Moreover in the case of the Soviet countries the frequent recasting of administrative boundaries creates a grave difficulty.

The Leningrad Atlas is accompanied by a separate Index and a Handbook, the latter containing useful English summaries of the textual descriptions in Russian of the various maps. In the Atlas itself the general map titles, and in a few cases the map key, are given in English as well as in Russian, but the titles of inset maps, graphs, and diagrams are in Russian only. It is of interest to note that the English word "relief," transliterated into Russian, has been adopted for the orographical map. So far apparently no Russian atlas has been produced for school use, but there are excellent wall-maps, based on well-known continental prototypes. The demand however outruns the supply, and it is expected that the Atlas under review will soon be difficult to procure.

E. G. R. T.

SOVIET GEOGRAPHY: the new industrial and economic distributions of the U.S.S.R. By N. MIKHAYLOV. Translated from the Russian by NATALIE ROTHSTEIN. Second edition, revised by the author. *London: Methuen & Co.*, 1937 (*first published in* 1935). 9×5½ *inches;* xviii+230 *pages; maps and diagrams.* 10*s* 6*d*

The first edition of this work was noticed in the *Journal* for April 1936 (p. 366). Although the pagination has been altered in the second edition and the book is now slightly smaller, the text remains substantially the same. A concession which helps to distinguish facts from propaganda is that the 1937 figures have now been marked "plan." The reasons for certain excisions are not readily apparent: the references to Obruchev's discoveries in the far north-east have, for example, been cut out entirely. The importance of the book lies in the fact that it is the only one in its field, but its imperfections remain. L. D. S.

ASIA

QUEST FOR SHEBA. By NORMAN STONE PEARN and VERNON BARLOW. *London: Ivor Nicholson and Watson*, 1937. 9×5½ *inches;* 258 (*inc. xii*) *pages; illustrations and route-map.* 12*s* 6*d*

As Mr. Pearn did not get very far in his quest for Sheba, he and his co-author (the actual writer of the book) have had to use a prodigious amount of padding to fill the 250 pages of their volume. Mr. Pearn's objective was Shabwa, which is a little more than 100 miles from Hainan at the western end of Wadi Hadhramaut. He left Hainan on the morning of August 25, passing the village of Rubai'a (which he calls Rubaiyz) to camp for a midday rest at some unnamed well near by, doubtless Bir Rashida, about 5 miles from Rubai'a and 15 from Hainan. He resumed the march at 2 p.m. and, an hour later, while photographing, found himself alone in the desert, abandoned by his guides. Walking on in the hope of coming up with them, he appears to have missed the Bir Jadida well; but a little later he met a party of Sai'ar Badawin carrying firewood to Hainan, and with them he returned to safety.

This misadventure seems to have discouraged Mr. Pearn, who subsequently

returned to Shihr on the coast by the Wadi 'Adim–'Aqabat 'Arsha route, which would have been well worth mapping, as it had not actually been travelled over before by any European between Suna and 'Arsha. He has however not contributed a single place-name to the map of this tract. Fortunately his omission is of little importance, as the route closely follows the modern Tarim–Shihr motor-route and actually crosses it—a fact which he does not appear to have noticed. This has been mapped, of course, though only recently.

Mr. Pearn has found Arabia inhospitable, but it is not altogether the fault of Arabia. His knowledge of the language was scanty. He was inexperienced in Arab ways, and he was financially ill-equipped. This last was his undoing, as he doubtless now realizes. Yet he (or his co-author) writes at the outset of his journey from Mukalla: "I took careful stock of those (the donkeys) carrying my paraphernalia of travel, especially the one bearing the five thousand Maria Theresa dollars packed in boxes." Does not Mr. Pearn realize that no one can carry that weight of silver or anything like it? And if he had anything like that sum, he would either have succeeded in his quest or been murdered on the way. At least he had the blessing of Aden and the cordial co-operation of the Sultan of Shibam; and he failed. Freya Stark turned her failure in the same quest to good account with a book of considerable charm, but Mr. Pearn's partner has not succeeded in a similar venture. H. StJ. B. P.

ARCHAEOLOGICAL RECONNAISSANCES IN NORTH-WESTERN India and south-eastern Iran, carried out and recorded with the support of Harvard University and the British Museum by Sir Aurel Stein. Antiques examined and described with the assistance of Fred H. Andrews and analysed in an appendix by R. L. Hobson. *London: Macmillan and Co.*, 1937. 12½ × 9 *inches;* xx, 268 *pages and* xxxiv (*plates*)*; illustrations and maps.* £3 3*s*

These reconnaissances, as they are modestly called, form intermediate links in a chain of archaeological exploration. The discovery in Sind, in 1923–25, of remains of an advanced civilization dating back to the 3rd or 4th millennium B.C., shattered many preconceptions of ancient Indian history, and aroused the keenest interest of Orientalists. Sir Aurel, who had previously found analogous material in Sistan in 1915–16, foresaw the possibility of tracing this so-called "chalcolithic" culture westwards through Baluchistan and Iran as far, at least, as Susa, where de Morgan's famous discoveries were made at the close of the last century. Rapid archaeological tours were made by him through Waziristan and north Baluchistan in 1927, and in south Baluchistan and Makran in 1927–28 as far as the Persian border, in the course of which many prehistoric sites, largely of the chalcolithic period, were found. Other work and his fourth expedition to Chinese Turkestan interrupted the pursuit of these explorations until January 1932, when they were resumed from the point reached in 1928. These further researches have already occupied four working seasons. This volume contains the record of only the first two seasons' work, (1) in the Punjab, Persian Makran, the Bampur and Halil Rud basins, and the Rudbar, Jiruft and Bam districts; and (2) in the Kerman area and the country intervening between it and the coast near Old Hormuz, and the fringe of the Gulf from Bandar 'Abbas to Bushire. A summarized account of these two seasons' journeys has been published (*Geogr. J.* 83 (1934) 119–34), to which reference may be made for topographical details. Having regard to the distance covered (over 2400 miles of country wholly unexplored archaeologically), hardships borne, obstacles met, and results achieved, it is a record of extraordinary energy and endurance for a man of his age.

As in the case of all Sir Aurel's work of exploration, this record has a twofold value, archaeological and geographical. From the points of view of archaeology and cultural history its outstanding importance lies in the tracing of a succession of sites yielding chalcolithic remains akin to those already found in the Indus basin and Baluchistan, thus linking up the Indus Valley civilization with ancient Susa, and shedding fresh light upon the connection between India and Western Asia in the prehistoric past. The objects collected in the course of these two seasons have been divided between the Iranian Government, Harvard University and the British Museum, the latter two institutions having helped to finance the expeditions. Some time must elapse before the mass of material can be fully classified and exhibited, when experts will be able to deal with the various questions involved. Meanwhile Mr. Hobson, of the British Museum, has contributed a short note (Appendix A) on the pottery fragments, many of which help towards dating some of the ceramic types of Iran and Makran.

The great value of the survey work carried out, often under very trying conditions, by his indefatigable assistant, Surveyor Muhammad Ayub Khan, in areas of which no accurate surveys had hitherto been made, will be appreciated by those familiar with the existing sheets, *e.g.* in Makran between Chahbar, Qasrqand and Fanuch, in the Halil Rud basin and the hills north-west of this up to Bardsir and Khinaman, and in the Charak and Naiband hinterlands.

A thorough local examination of the north-eastern parts of the Salt Range in the Punjab has enabled Sir Aurel to indicate, we think conclusively, the line of Alexander's march from Taxila to the Jhelum, the site of his camp (near Haranpur) on the right bank of the river, and of his crossing (at Jalalpur) to attack Poros, whose army was drawn up near the present villages of Miani and Malakwal. Some other sites in the Salt Range mentioned by the Chinese pilgrims Fa-hsien and Hsüan-tsang (fifth and seventh centuries A.D.) were also identified by him. In Iran he investigated locally the questions of Marco Polo's "city called Camadi" (now Shahr-i-Daqianus) and his way thence by "the route of Reobarles" to Hormuz. He also searched for traces of Old Hormuz (the Harmozeia of Nearchos), and found at two sites, about 12 miles south-west of Minab, surrounded by flat ground now liable to be flooded, remains that had doubtless belonged to places connected with the shipping of the old port. As regards Alexander's passage through Gedrosia and Karmania, Sir Aurel thinks that the then capital of Gedrosia (*Πουρα*) must have lain somewhere in the vicinity of Bampur (p. 113) and that "his way to Karmania, the present Kerman, led past Jiruft" (p. 136). As to the site of *Πουρα* there can hardly be any question, but as to his route through Karmania, need we assume that he went to the capital town, and, if so, that the then capital lay so far to the north? Bardasir appears to have been the Persian name of the present Kerman in former days. The early Arab geographers name Sirjan and Jiruft as the principal towns of the province. Ibn Khurdadbih (mid-ninth century) tells us that Jiruft was the largest town, but that the governor lived at Sirjan. Idrisi (mid-twelfth century), who says Sirjan was the seat of government, marks no *town* Kerman on his world map of 1154. Even Abu'l-Fida (beginning of fourteenth century) calls Sirjan the capital of the province, though he also says that Bardasir was the capital in the time of Ibn Sa'id (thirteenth century). However we must await the separate paper in which Sir Aurel proposes (p. 177) to discuss Alexander's route from Gedrosia to Persis.

The evidence found of change in local physical conditions since prehistoric times has also received attention. For instance, at Tiz on the bay of Chahbar, once a busy port and called the capital of Makran by some of the Arab geo-

graphers, now "a squalid little fishing village," as Holdich described it, no remains indicating occupation in pre-Muhammadan times could be traced, although the site is evidently the Τεισα of Ptolemy—an identification which, it may be noted, is attested by the name, Al-Taisa, given it by Idrisi on his map. Similar absence of pre-Muhammadan remains was noticed at the sites of Old Hormuz and Siraf (now Tahiri), once emporia of trade by sea and land. Sir Aurel is led to suggest subsidence of the coast land at these places as a possible explanation. On the other hand, W. T. Blanford in 1871–72 (Records G.S.I. V. Pt. 1, p. 45, Pt. 2, pp. 76–77) noticed evidence of "recent elevation" near Gwadar, Jask, east of Hormuz, on Hanjam and Qishm islands, and at Bushire, while on the Oman coast the features seemed to him to indicate subsidence. Such movements have perhaps alternated in the course of ages. Again, while abundant prehistoric remains were recovered in the Bampur oasis, from thence westwards for some 160 miles across the Jaz-Murian depression, now almost wholly desert, up to the terminal course of the Halil Rud no evidence of prehistoric occupation was found. As cultivation in this tract can only be carried on by means of *qanats* (underground water channels), Sir Aurel makes the interesting suggestion that the *qanat* (or *karez*) system, old as it undoubtedly is, had not been introduced in those early times. Another possible explanation seems to be that the Halil Rud and the Bampur rivers, both of which terminate in this depression, carried down greater volumes of water in prehistoric times, and that the Hamun then extended over a much wider area. Could the old highway from east to west have lain along the southern flank of this depression?

The numerous illustrations and plans have been very clearly reproduced, and the draughtsmanship of the two sheets of maps is excellent; the plates (six of which are in colour) have been admirably printed, while the skilful grouping of the objects reveals the hand of an artist. C. E. A. W. O.

THE EAST INDIA COMPANY'S ARSENALS AND MANUFACTORIES. By Brigadier-General H. A. Young. *Oxford: Clarendon Press*, 1937. 9×6 *inches;* viii+244 *pages.* 12*s* 6*d*

Geographers are sometimes apt to base the causes of concentration of industry on geographical factors and to pay too little heed to historical and other events. General Young, who spent twenty-eight years in the Indian Ordnance Department, shows that many other factors besides purely geographical ones have affected the position and growth of the military supply factories in India. This very interesting volume is the result of researches carried out by him over a period of ten years or so among original documents at the India Office and other places; and, though it deals mainly with the historical side of the factories and their personnel, it gives many points of value to the historical geographer. It is interesting for instance to examine the success or failure of certain military supply factories in relation to the climate or to the resources and communications of the district in which they were set down for purely military reasons, and to note how the authorities attempted to make the district fit the industry. A little more knowledge in the first instance, and a little more thought, would have saved an infinity of worry later. There are many delightful stories that appear strange reading to-day. Perhaps the best is that of Robert Fletcher, who started his Indian career about 1757 as assistant to the Military Storekeeper at Madras. He was dismissed three years later for insolence to the Government, but apologized and was reinstated. In 1763 he was promoted major, but again, after three years' service in that rank, was cashiered, this time for mutiny. Once more he was forgiven and this time he rejoined with the rank of full colonel in 1771. Four years later he resigned and returned to England, but only to make

a last appearance on the Indian stage as Commander-in-Chief in 1775. These were "the good old days." K. M.

JOURNAAL VAN J. J. KETELAAR'S HOFREIS NAAR DEN GROOT Mogol te Lahore, 1711–1713. Edited by J. PH. VOGEL. (Werken uitgegeven door de Linschoten-Vereeniging. XLI.) *'s-Gravenhage: Martinus Nijhoff*, 1937. 10×6½ *inches;* xxviii+454 *pages; illustrations and map*

This book gives the records of the mission sent by the Dutch East India Company to congratulate the new Mogul Emperor and obtain a confirmation of the privileges which had been granted by Aurangzeb, together with such improvements in them as might be procurable. It was a tedious business. Leaving Surat in February 1711, the mission reached Agra in June, where it halted for the rainy season, and then went on to Lahore. Negotiations here lasted from December 1711 to May 1712, and the mission was back in Surat in February 1713. By this time the throne of Delhi had changed hands; and since the favours granted by an Emperor did not bind his successors, the huge expenditure (over 1,200,000 guilders) was practically wasted. The records of the mission are unhappily incomplete. Copies of the journal cover the period from December 1711 to February 1713, but the upward march has to be reconstructed from letters and other documents, which are printed as appendices. In this reconstruction, as throughout the whole volume, Professor Vogel's service in the Indian Archaeological Survey has stood him in good stead; familiar with the topography, he has had to do very little guessing. In point of technique the book seems entirely satisfactory.

The interest of the account is historical rather than geographical. It gives, with Dutch elaboration of detail, a vivid picture of the collapse of the Mogul Empire. For the geographer there is not much that is new. Except for one deviation the routes followed by the mission were those familiar in the seventeenth century, and Professor Vogel tells us (p. 34) that they were already clearly laid down in the atlas of the brothers Blaeu (1646). The deviation is of some little interest. The western route from Surat to Agra struck first due north, and then north-east, from Ahmadabad, keeping to the west of the Aravalli range as far as Ajmere, and thence eastward; the mission kept to the east of the Aravallis, passing through Dungarpur and Mewar, and rejoining the usual route near Jaipur. We possess so little knowledge of Mewar about this period that the experience of the travellers in this region would have been most welcome, but the journal is missing, and the extant documents disclose little more than the names of the principal halting places.

The route-map is clear and adequate, and the illustrations are well reproduced and relevant to the text. There is a good index. W. H. M.

TRADE IN THE EASTERN SEAS, 1793–1813. By C. NORTHCOTE PARKINSON. *Cambridge: University Press*, 1937. 9×5½ *inches;* xii+434 *pages; illustrations and maps.* 16*s*

Dr. Parkinson's scholarly work touches geography at so many points, and throws so much light on the historical geography of an important, if limited, period of the history of the East India Company, that it may be doubted if any more can be said on the subject. Articles of trade; site, importance and function of the ports; navigation routes in relation to the prevailing winds; the strategy of the convoy system; the resources of India; the tea trade of Canton—these are some of the many topics dealt with, and on each the author writes with authority. One misses direct reference to Sir Arthur Wellesley's admirable 'Memorandum upon Seringapatam,' in which he dealt with the relation of geography to the defence of southern India, but this is perhaps not strictly

relevant to Dr. Parkinson's theme. For the book as a whole there can be nothing but praise. Nor will it appeal to scholars only. There is pleasure to be found in many of the author's pungent sentences, while the general reader will find delight in the descriptions of India House or of the trials of passengers to India who travelled in cabins that "made up in free circulation of water for what they lacked in free circulation of air." A number of appropriate illustrations complete a work for which the publishers and the author deserve warm congratulations.

J. N. L. B.

TRANSACTIONS OF THE GLACIAL EXPEDITIONS. Vol. II. Tien Shan: headwaters of the Great Narin River. 436 *pages*. Vol. III. Zeravshan: headwaters of Zeravshan and Fandaria Rivers. 416 *pages. Leningrad: U.S.S.R. Committee of the Second International Polar Year at the Central Administration of the Hydro-Meteorological Service*, 1936. 9×6 *inches; illustrations and maps*. 18 *and* 15 *roubles*+2 *r. each for binding*. [In Russian; with English summaries]

The report on the Tien Shan in the second volume of the Transactions of the Glacial Expeditions organized by the U.S.S.R. Committee of the Second International Polar Year consists of eleven articles (a cartographical supplement included) by members of the Narin-Khantengri expedition of 1932 and 1933. Completed a few months after the return of the expedition, many articles are of a merely provisional nature. Seven of them are completely or in part contributed by S. V. Kalesnik, the geologist who was in charge of the expedition (and later the editor of the "Transactions"). In two of his articles he surveys the work and the achievements of the expedition during two seasons in 1932 and 1933. Two other articles by him describe the various glaciers at the head waters of the Great Narin River, whilst three articles in collaboration with the assistant geologist, S. V. Epstein, give an account of the entire area, and of some of its formations, from a geological point of view. The oro-hydrographical investigations are outlined by Mme. Bykova, the geomorphologist of the expedition. The climatic conditions and the meteorological observations are described in two articles by A. Kh. Zavadovsky.

Apart from an imposing number of tables, maps, and views appertaining to various articles, the book contains a Glacier Atlas by S. P. Vorobiev. It serves as a supplement to S. V. Kalesnik's survey of the numerous glaciers and consists of 19 tables depicting the tongues of 21 glaciers, out of 64 visited by the expedition.

All articles in this volume are arranged in two groups in accordance with the periods of investigation, and each group is supplied with a short English summary. But the two summaries are of different kinds, for the first one deals with each article separately, whilst the second one is mainly concerned with the group of articles as a whole.

The third volume of the Transactions differs essentially from the first two numbers of the series. In contrast to the Pamir and the Tien Shan reports the Zeravshan volume is not limited to the work carried out in 1932 and 1933. The article by P. F. Domrachev dealing with Iskanderköl—the longest article in this volume—is based entirely on earlier investigations. It describes the hydro-chemical and hydrographical researches made by Domrachev in 1931 and sums up the topographical, morphological, geological, and other investigations carried out by various scientists since the end of the nineteenth century.

Nevertheless the greater part of the book is devoted to the expedition sent to Zeravshan by the State Hydrological Institute in 1932 and 1933. A general outline of its work and achievements is given by I. A. Kireyev, the leader of

the expedition, who is also the author of two special articles: a hydrographical description of the Yagnob river, and an article dealing with some hydrographical problems in general. The organization of hydrometric work and the temperature régime in the Zeravshan basin are described by the hydrometrist, S. G. Obnorsky, and by the meteorologist, P. P. Kuzmin, respectively. The three geomorphologists of the expedition, V. E. Gordienko, Mme. Nenastieva, and E. P. Konovalov, have contributed articles on glaciological and geomorphological work in the head waters of the Yagnob river, on geomorphology of the valley of the Zeravshan river, and on investigations of the Zeravshan glacier.

According to a preface by I. A. Kireyev the present volume has in no way exhausted the material accumulated with regard to the rivers Zeravshan and Fandaria. It was therefore intended to issue a supplement within a short time.

The book contains a number of maps and tables as well as some views. All articles with the exception of two by I. A. Kireyev are provided with short English summaries. L. L.

AFRICA

STUMME FRONT: Männer und Mächte im Banne der Sahara. By H. SCHIFFERS-DAVRINGHAUSEN. *Leipzig: Wilhelm Goldmann* (1936). $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 330 *pages; illustrations and maps. M.*4.50

In this work the author deals with the European penetration and subjection of the Sahara. The first three sections deal with the "attack" from north and west, and the first traverses of the desert; the fourth and fifth with the French conquest of the Western Sahara, and the Italian conquest of Libya. The arrangement of the book makes it difficult to comprehend the subject as a whole; the opening section, for example, describes the death of General Laperrine in the desert in 1920, and much later there is an account of Caillié's journey to Timbuktu in 1827. Though due credit is given to other European explorers, it is the achievements of German explorers that are treated in detail, particularly Heinrich Barth and Gerhard Rohlfs. The style of the writing strives to heighten the dramatic effect, sometimes at the expense of lucidity. The book is completed by a useful classified bibliography, and an extensive index, which contains a good deal of information not to be found in the text. The sketch-maps are scarcely worthy of the text. G. R. C.

NORTH AMERICA

TRAVELS IN THE INTERIOR INHABITED PARTS OF NORTH America in the years 1791 and 1792. By P. CAMPBELL. Edited by H. H. LANGTON, with . . . W. F. GANONG. (The Publications of the Champlain Society. XXIII.) *Toronto,* 1937. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* xii + 326 *pages; illustrations*

The Champlain Society has performed a useful service by reprinting Patrick Campbell's 'Travels in North America.' The book was originally published in 1793, and had become exceedingly rare. Little is known of Campbell's life, but the editor of the new edition has assembled all that can be found out about him in an Introduction, and has also discovered three portraits which are reproduced in the volume. Patrick Campbell tells us that he "set out from the Highlands of Scotland, with an intention to explore the interior inhabited parts of North America, attended with an old faithful servant, a Dog, and gun, only." His object was "to give to such of his countrymen, as had any thoughts of emigrating to America, room to judge for themselves." The route of his journey from Saint John to Montreal, Kingston, Niagara, New York and back to Saint John was of no importance as a feat of geographical exploration. Nevertheless

the book is valuable because about half of it is devoted to a description of New Brunswick. Campbell was in this Province less than ten years after it had received a great wave of immigrant Loyalists in 1783. New Brunswick was separated from Nova Scotia in 1784, and Campbell is the first writer to give a detailed account of the newly created Province. Campbell's lively descriptions are full of interest and amusement, and the fact that he pays so much attention to the economic possibilities of the land makes the book especially useful.

E. W. G.

UNDER WESTERN SKIES: being a series of pen-pictures of the Canadian West in early fur trade times. By ARTHUR S. MORTON. *Toronto [and London]: Thomas Nelson & Sons*, 1937. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 232 pages; illustrations and sketch-map. 7s 6d*

Here are collected together a series of articles which appeared originally in the *Star Phoenix* of Saskatoon. They are popular and descriptive in character and deal with those who early had interests in Western Canada; with explorers, fur traders, and pioneers, and in particular with those employed by the Hudson Bay Company.

Each article is self contained, and there is no attempt at formal historical or geographical treatment. The early chapters describe the nature of the prairies and the mode of life of the Indians, as also the effect of the coming of the white man, with his horse and his gun. These slight notes are perhaps the most readable portion of the book, which throughout betrays an intimate knowledge of the history and of the geography of western Canada. It should appeal to the general reader in this country, and may be read with profit by the geographer.

Ll. R. J.

CENTRAL AND SOUTH AMERICA

ANTROPOLOGÍA Y SOCIOLOGÍA DE LAS RAZAS INTERANDINAS y de las regiones adyacentes. By ARTHUR POSNANSKY. *La Paz: Instituto Tihuanacu de Antropologia, Etnografía y Prehistoria*, 1937. $10\frac{1}{2} \times 7\frac{1}{2}$ *inches; 150+iv pages; illustrations and maps*

This book is excellently illustrated, and the splendid photographs of native types and native life make it quite obvious that it is the work of a man who has been living with them for a life-time. The main thesis of the book is that there were originally two races on the continent of South America, the Aruwaks and the Kollas. The Aruwaks submitted to their adversaries after a long struggle, and as witness of that war there remains a chain of *Pukaras*, stone fortresses, stretching along the ridge of the Andes in lat. 25°. After the conquest, the two races mixed and formed a new race, whose culture is typified by the arts and crafts of the third Tihuanacu period. This new race, the Keshua, developed a language of its own, distinct from the Aruwak and Kolla groups.

The author finds traces of the old Aruwak culture in old monuments and objects of art, such as are to be found in Tihuanacu, the small river island of Simillake, and the districts formerly occupied by the Changos on the Pacific coast. He also made an exhaustive research into the comparative philology of the native dialects. But he mainly relies upon anthropological measurements carried out on natives and, occasionally, on skulls. He further analyzes native institutions. Thus he is able to discover not only the existence of relatively pure Aruwak and Kolla types, but also to establish the existence of small local groups of the once predominating Aruwak race, whose religious symbol, the sign of the three steps surmounted by a volute, is to be found all over the continent.

The most interesting parts of the book are perhaps the descriptions of several of these small native communities. There are first the Chikayas in Eastern Bolivia. They adopted Christianity, but coupled it with many features of their own religion. Thus they preserved the cleansing sacrifice of the Wilanka festival, but hold it together with the feast of the Holy Spirit. Next comes a small community of forty households, the relics of an Uru tribe, living on a river 20 miles from lake Titicaca. The most important building in their village is the church, whose minister visits them once a year. Otherwise they remain, except for trading with other tribes, a self-contained community. They are specialists in the construction of shallow reed boats and reed mats, which they exchange for various goods, alcohol, and the devastating coca. Their main industry is fishing, but they also organize communal hunting expeditions, catching water birds without the use of firearms. A further occupation is the carrying of loads on the rivers of the district. There is a strict division of labour between the two sexes, the women doing the cooking and working on the mats and boats, the men doing the hunting and fishing and the later stages in the making of the mats and boats. They are organized in four groups of four families under a chief who adopted the Spanish title of *alcalde*. The last Uru group described lives on the island of Panze in Lake Poopó. There is a charming account of how the author visited them and by presents, good will, patience, and some brandy persuaded them to speak their own language which at first they had pretended not to know. He also moved them to allow him to dig out some skulls, by appealing to their pride, for these skulls were the only means of establishing that they once belonged to a mighty race; and their sense of pride proved to be stronger than their fear of the spirits of the dead. They also do not live entirely to themselves, the adult men working in the mines of Chile.

The reader will be impressed by the rapid disintegration and disappearance of many tribes in recent times. We may hope that work undertaken with the deep understanding of these tribes which the author displays will serve to slow up and possibly arrest this process. R. B.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

THE AGE OF THE EARTH. By ARTHUR HOLMES. New edition. *London: Thomas Nelson & Sons*, 1937 (first published in 1927). $6\frac{1}{2} \times 4$ *inches;* 264 *pages (inc. x); diagrams.* 1*s* 6*d*

The present book is the successor of one published in 1927, but it is considerably enlarged and re-written. The most noteworthy addition is on the new helium method of determining ages of igneous rocks containing only small amounts of uranium and thorium. A detailed comparison in the form of a diagram shows a highly satisfactory agreement between ages found by this method and the lead one. A new refinement is the allowance for the actinium series. The dating of geological formations is evidently proceeding rapidly, and in the Pre-Cambrian the absolute ages given by radioactivity appear to be capable of determining the historical order of formations where ordinary geological methods break down for lack of data.

Followers of Holmes's recent work will be surprised to find no mention of thermal cycles, convection currents, calcium[41], or continental drift. He still however appears to find difficulty in being fair to the thermal contraction theory, the present form of which largely rests on arguments that he himself provided. His objection to it depends on a comparison of the result that mountain formation should decrease in rapidity with time, suggested by the original form of the theory, with the age determinations suggesting that the intervals

between stages of mountain formation have shortened since the earliest times. There is no reference to the fact that a term in the cooling, not taken into account till 1932, would give contraction at a uniform rate; there seems to be no evidence of anything but irregular variation in the intervals quoted, certainly none of a steady decrease. He does not mention that intermittent mountain formation is implied by secular changes in a material with a finite strength and has not been explained at all on any other hypothesis; and a finite strength implies cooling if the earth was ever fluid.

A remarkable result appears on p. 75. It is estimated that the denudation of igneous rocks should have produced sediments containing only 6 to 16 per cent. of sandstones. The actual percentage is given as 32 to 37. Holmes infers that the original rocks of the surface contained much more free silica than the present igneous rocks. The actual percentage however is not an average over the earth, but is based on the regions of maximum thickness of the various formations, totalling 700,000 feet. An alternative hypothesis would therefore be that the difference is due to a sampling error, due to the maximum thicknesses containing too much sandstone to be representative of average conditions.

The most important part of the book deals with the estimates of geological time from radioactive processes; these are up-to-date and excellent. H. J.

THE PHYSICAL BASIS OF GEOGRAPHY: an outline of geomorphology. By S. W. WOOLDRIDGE and R. S. MORGAN. (The University Geographical Series. General Editor: L. DUDLEY STAMP.) *London: Longmans, Green and Co.*, 1937. 9×5½ *inches;* xxii+446 *pages; illustrations and maps.* 12*s* 6*d*

This book was written in the modest hope that it will prove of "service to students reading for an honours degree in Geography." There can be little doubt that the hope will be realized, for the work is comprehensive, well designed, and well illustrated.

The "Bibliographic notes" comprise references to enable the student to wander farther afield should he so desire and are moreover accompanied by a few words of explanation which should prove of assistance in consulting other authorities.

As pointed out in the Introduction, the subject falls into two parts: the first and shorter concerned with geophysics and structural geology, the second with land-forms. In dealing with the first the authors naturally found themselves confronted "with a veritable jungle of conflicting hypotheses." With Du Toit, the late J. W. Evans, E. B. Bailey and others, they are sympathetic to the broad theory of Continental Drift, and there is a valuable discussion of this, of the permanence of ocean basins, and of the constitution of the Earth's crust. There are good explanations of structure due to compressive forces and mountain building, involving the definition of geosynclines, the conception of "hinterland" and "foreland" boundaries, and the formation of nappes and kindred structures. More emphasis on the work of Suess might fairly have been given; "Das Antlitz der Erde" and the translations should certainly have been included in the bibliography.

In the second section of their volume, the authors enthusiastically follow W. M. Davis and his school and adequately describe the evolution of drainage systems, their adjustment to structure and denudation chronology, examples being taken from the Appalachian Region and the Weald. The influence of glaciation on topography and the hypothesis of glacial control are summarized, the latter subject involving a review of geological opinion on Pleistocene glaciation in Europe and America. This chapter is a useful sketch for the general reader as well as for the student.

The illustrations, 272 in number, are usually diagrammatic sketches drawn almost entirely from European and American examples. One of the exceptions, that of the Rift Valleys of East Africa, shows the two major troughs in the neighbourhood of Lake Victoria and a few of the associated faults in Tanganyika Territory: a usual procedure, but scarcely sufficient for a just appreciation of this gigantic system of fractures. In regard to the origin of the Rifts, the tension theory is favoured as distinct from the compression hypothesis supported by the Geological Survey of Uganda. One curious slip must be noted. The authors say, "the marsupial characterizes Australia; the only other living marsupial occurs in Chile." The distribution of the opossum is of course much wider. Also, it should be noted, the "blind snakes," presumably the *Typhlopidae*, are not confined to the "southern continents," as stated. There is an adequate index. J. P.

PHYSICAL GEOGRAPHY: a short course for middle forms. By H. ALNWICK. *London: George G. Harrap & Co.*, 1937. 10×7½ *inches;* 124 *pages; illustrations and sketch-maps.* 3*s*

This book is intended for pupils between fourteen and sixteen years, and the author tells us that the material and the method of presentation have been chosen mainly to satisfy the argumentative nature that develops at about the age of fifteen. A systematic and orthodox treatment is therefore not to be expected and, in this respect, the book is refreshingly different from most elementary Physical Geographies. It is very fully illustrated with ingenious and attractive line drawings by the author; a method which, in a subject concerned with small but significant variations of shape, possesses manifest advantages over verbal description. Homely similes are introduced to explain concepts presumably regarded as too difficult for assimilation by junior pupils, but the similes are of varying degrees of aptness, and, while some of them will simplify understanding, others are likely to give rise to erroneous conceptions. It is a pity that some of the drawings perpetuate errors that are distressingly common in school work, particularly a gross exaggeration of vertical scale and a relative disproportion of landscape elements which gives rise to some very unnatural landforms. Advanced and controversial theories have been freely introduced to stimulate interest, but it is to be hoped that these chapters will remain unread except where the master is prepared to expound and expand. In any elementary presentation of the more abstruse ideas on such a subject as physical geography half-truths are inevitable, but a chapter of three pages devoted to modern theories of mountain building, which ranges over isostasy, the tetrahedral theory and the hypotheses of Wegener and Joly, seems likely to give rise to chaotic ideas in the schoolboy mind.

There are chapters on weather and climate and a series of note-book exercises designed to relate the physical basis to the human and regional aspects of geography. A. A. M.

CARTOGRAPHY

THE UNIVERSITY ATLAS. Edited by GEORGE PHILIP and H. C. DARBY. *London: George Philip & Son, Ltd.*, 1937. 15×11 *inches;* xvi+96 *pages* (+36 *pages index*). 10*s* 6*d*

The production of atlases for university students does not, fortunately, proceed at the same rapid rate as the issue of text-books for their use, and accordingly the publication of Philip and Darby's University Atlas was something of an event. Although students are encouraged to use the large-scale topographic maps of the various national surveys as far as possible, there is great use for a

portable atlas which shall contain not only physical and political maps of all parts of the world but also a selection of the many other types of map—structural, climatic, vegetation, soil, and population—which form part of the geographer's equipment.

The compilers of this atlas divide the contents of their work into four sections. The first includes general maps showing the basic distributions (geology, relief, soils, climate, vegetation, population, etc.). This is the most novel and interesting section, from the point of view both of the material and the manner of presentation. Equal-area projections being desirable for distribution maps, a modification of Goode's Homolographic projection—called by the compilers the "Interrupted Mollweide's Homolographic"—is employed for world distributions. This must be the first considerable attempt in this country to follow the American lead and break away from the conventional Mollweide and Mercator which have held the field for so long in English atlases. Almost the only case in which the interrupted projection is not employed is a world political map. Here a desire to include trade routes has been responsible for the retention of the Mercator—and northern Canada appears much too large. Many of the maps in this section, notably structural, vegetation and soil maps, have been compiled from several sources—the structure of Europe, for example, is after Suess, Bertrand, Sederholm, Haug, de Launay, and Kober—and may be considered as useful attempts to present in a comparatively simple form much scattered and often specialized material not easily accessible to geography students. A valuable addition to this general section comprises seven pages of graphed climatic statistics of temperature, pressure, and rainfall for over 200 stations throughout the globe. There are also two pages of text, with illustrations, on map projections, especially useful for the junior student whose syllabus frequently includes "a study of simple map projections and their use in atlases."

The second section consists of a series of maps of continents and countries, showing relief and the location of the more important places. The distinctive features of this part of the atlas are the employment of easily comparable scales (all being in millionths, from 1/4 M to 1/30 M), the extensive use of the conical projection with two standard parallels, and the rather gaudy, but not unpleasing, colour scheme employed for the relief layering. The transition from bright green through light brown to magenta gives the maps something of the appearance of the original International 1/Million. The printing is good and the registration of high quality. The maps are not too crowded with names; indeed in some cases more detail might quite comfortably have been added. France perhaps receives somewhat inadequate treatment: it is confined to one page and a 1/4 M scale, whereas western Germany and the Low Countries get a two-page map on a 1/2 M scale.

The third part includes a series of larger-scale maps (actually 1/M) of the British Isles, or "home countries." These, in the opinion of the reviewer, are the least successful maps in the atlas. A scale of this kind might easily have permitted a much more detailed showing of relief: the placing of the first contour at 300 feet leaves the greater part of England coloured bright green.

Finally there is an adequate and legible index, which permits of easy reference to the maps.

A university atlas, as the compilers admit, must be a compromise. It must be something more than a mere collection of relief maps with place-names, yet it cannot hope to include all the various kinds of maps which the student must study. This particular atlas has attempted to give the student a handy companion to his studies of the physical environment, by including geological, climatic, and vegetational information derived from the most reliable sources.

It is intended to issue a Library Edition containing a supplement consisting of diagrams and charts of the world's commercial development. The reviewer would suggest that this supplement, if combined with a series of up-to-date agricultural distribution maps on the lines of Finch and Baker's "Geography of the world's agriculture" (which was based on pre-war data), and with other maps of economic distributions, might well form a kind of economic companion to the physical maps in the atlas under review. S. H. B.

ECONOMIC AND HISTORICAL GEOGRAPHY

CO-OPERATION AND COMPETITION AMONG PRIMITIVE Peoples. Edited by MARGARET MEAD. *London: McGraw-Hill Publishing Company*, 1937. 9×6 *inches;* xii+532 *pages.* 24*s*

This volume, written in collaboration by a group of anthropologists, is an attempt to portray thirteen divergent cultures and to evaluate them in relation to a particular sociological inquiry. The subject of inquiry is the nature, extent, and conditions of competition and co-operation in primitive societies, and is sufficiently broad and fundamental to provide a theme for a comprehensive sketch of the social structure and economic organization of each of the cultures studied. The book is therefore of value, quite apart from the significance of generalizations reached on the specific problem, as a source for succinct and critical sketches, often based on unpublished or inaccessible material, of a number of peoples who span the gamut of the primitive world. The subjects of this series of short monographs are the Eskimo, the Canadian Ojibwa, the Kwakiutl of Vancouver Island, the Iroquois, the Dakota, the Zuni, the New Guinea Arapesh, the Manus of Melanesia, the Samoans, the Maori, the Philippine Ifugao, and the Chiga and Thonga of eastern Africa.

In the course of their work the authors were necessarily compelled to establish a number of agreed definitions of the sociological concepts involved, and they distinguish at the outset between collective and individual activities and also between these and co-operative, competitive, and individualistic goals. It is also made clear that behaviour cannot be assigned to any of these categories except in relation to a specific cultural pattern. Beginning with a "slight leaning toward a dependence upon the environmental factor, an expectation that scarcity of food or materials, or technological practices . . . might have a determining influence" on the general cultural pattern, they found that their results pointed clearly, so far as the selected cultures were concerned, not merely to the inadequacy but to the irrelevance of physical conditions as causative factors; and Dr. Mead regards as their most "basic conclusion" the finding "that the goals for which individuals will work are culturally determined and are not the response of the organism to an external culturally undefined situation, like a simple scarcity of food" (p. 16). A number of generalizations valid for the cultures concerned and offering working hypotheses for further study emerge from the comparative analysis given in the lengthy "Interpretive Statement" to which the Editor somewhat pedantically denies the status of a conclusion. The more important of these, which are not without significance in the study of Western society, may be indicated. A valid distinction is found between co-operative and competitive social systems, *i.e.* "societies in which the distribution of goods is a major competitive activity and those in which such goods enrich the whole group" (p. 462). While these differing systems are found to have a high correspondence with "major cultural emphases" or social philosophies, neither they nor the "emphases" show any consistent relation to physical conditions, subsistence level or technical equipment; thus the Arapesh

and Zuni—among whom a scarcity of land is said to lead to no competition between individuals or groups on account of the customary co-operative attitude to labour and land use—afford instances of the overriding of physical limitations by cultural emphasis, while the Kwakiutl on the other hand squander lavish natural resources in a fiercely competitive ostentation.

Dr. Mead finds in the variable attitudes towards individual status an important clue to the problem dealt with in this volume. Status is strongly emphasized and is modifiable by personal action in the competitive as contrasted with two of the co-operative societies studied. The co-operative Dakota are however anomalous from her standpoint, although the social strain said to result from the variability of status does not emerge clearly in the sketch itself, and it may be doubted whether Dakota gift prestige is really comparable to status rivalry among the Kwakiutl and Ifugao. In his study of the Kwakiutl Mr. Goldman performs the valuable task of integrating the abundant but scattered material collected over many years by Professor Boas. But, as in Boas's own studies, the megalomaniacal rivalry of the titled leaders of households and lineages is over-emphasized at the expense of the co-operation within households and kin groups which underlay the remarkable accumulations of food and goods. This objective co-operation of groups of commoners in support of the prestige of their noble kin would appear to distinguish the Kwakiutl from the Ifugao more strongly than is made clear in the comparative analysis, and one feels that this would not have escaped attention had more notice been paid throughout to the actual size of the social groups whose structures are analyzed in this volume. The Dakota study is marred by a number of unguarded functionalist assumptions of causation. It is assumed for example that division of labour caused, and could not result from, co-operation in the household group, and, in connection with the general social conformity of the Dakota, the attribution of aberrance to supernatural effects is regarded as explained by a claim "they had to have ways in which to account for those who could not subscribe to the roles demanded of them" (p. 415). Miss Ruth Landes, in a sketch which is outstanding in clarity, portrays from her own field studies the intensely individualistic, as distinct from competitive, social conditions among the Ojibwa hunters. The monogamous households which operate as isolated units during the winter's hunting—well adapted to the scattered character of the game resources—retain their economic and social independence in the villages temporarily occupied in spring, summer and autumn, and there is virtually no co-operation in the activities of these seasons. Within the Ojibwa household there are complementary rather than co-operative relations between men and women, and personal individualism is reflected in the absence of common household property and complete freedom of disposal of property at any time according to personal choice.

The later part of Dr. Mead's conclusion is devoted to a consideration of the variety and relative weight of social stimuli which condition the attitudes of the developing individual. While of intrinsic interest this section has relatively little continuity with the earlier discussion, and the material available in the studies themselves is admittedly inadequate. The special interests of the Editor and the fact that a Committee on Personality and Culture initiated this study appear to be responsible for the inclusion of this problem which deserved more adequate and separate treatment.

It is unfortunate that the book has been so highly priced, as it is likely to restrict its circulation among many who would find it useful, including geographers who share the bias which the writers of this volume were compelled to abandon.

C. D. F.

COLONIAL POPULATION. By ROBERT R. KUCZYNSKI. Published under the auspices of The Royal Institute of International Affairs. *London: Oxford University Press*, 1937. 9×5½ *inches;* xiv+102 *pages.* 5*s*

The aim of this little volume is to state the facts concerning the population of the non-self-governing territories of the world. The introduction is a critical review of the value of published official figures for colonial populations, based mainly on analyses of the census reports. The author makes it clear that, for a large majority of the population concerned, these can only be classed as either reasoned guesses or, at best, estimates; and that our knowledge even of the actual numbers is very inadequate; while there is even less reliable information of the sex, or age, or racial, composition of these colonial populations, or of their rates of increase or decrease. The total figures are at best a reasoned guess; and any deductions from them are limited by that fact.

The four chapters, pp. 1–36, give summary tables of the official published figures, and some brief discussion of them. In Chapter II the various classifications by race are stated and compared. These vary so widely in different colonies that the published totals are of no value for comparison. Chapter IV states the position of registration of births and deaths, but gives no totals because the data are too scanty.

The remainder, the larger part of the book, pp. 37–97, consists of "Notes to the Tables" which state the sources of the figures used and explain the terms employed. The brief index gives only the names of the territories referred to.

The book does a real service in bringing together widely scattered data. It is well documented, and will be a valuable reference wherever such data are wanted. Its criticisms of colonial "censuses" deserve to be read by every one who has any responsibility for such a census or who makes any use of its results. In that case it may lead to some improvement. C. B. F.

SIEDLUNG UND MACHTPOLITIK DES AUSLANDES. By RUPERT VON SCHUMACHER. (Macht und Erde. Edited by K. HAUSHOFER and U. CRÄMER. Heft 5.) *Leipzig: B. G. Teubner*, 1937. 8½×6 *inches;* 74 *pages. M.*1.50

The object of this booklet is to give a brief survey of the political aspects of settlement and colonization in all their varying forms in different parts of the world: garden cities and the strengthening of frontiers come within its scope. The limitations of such a survey are obvious. The author is touching on the political aspects of a problem which is principally economic and geographical, and this, apart from other reasons inherent in such an inquiry, is undoubtedly responsible for the distortion from which the account suffers: there is an attempt, for example, to turn the flank of the land reform initiated in Austria after 1848 by insisting on the historical reasons for the defects then remedied. The author being freed from any need to consider physical geography, land becomes simply the abode of "ein Stück Mensch," to be cultivated, colonized, and defended irrespective of cost: a conception that has its own defects (one would hardly gather from the map provided and a casual remark in the text that a part of Australia is uninhabitable) together with those of the author (who dismisses Russian experiments in the Arctic as a military threat to Scandinavia). Much space is given to the Czechoslovakian solution of the problem of frontier settlement, which is regarded as the kernel of national policy and a test of national virility. There is also some interesting information on a settlement that is less directly military in purpose: in Bulgaria, where the influx of refugees from provinces lost in 1918, the lack of large estates to partition, and the desolation resulting from three wars, posed a problem solved

under the supervision of the League of Nations, and aided by the creation of a *Landarbeitsdienst* later copied elsewhere. Yet apart from such incidental items of interest, and the fact that much play is made with definitions of *Siedlung*, one is left with the impression that the work is at best pseudo-scientific, and that its real object is propaganda based on vague notions such as "Lebensvorgang einer Gesamtheit" and "Blutverwandschaft mit der Erde." J. P. H. M.

THE ABBÉ DU BOS: his advocacy of the theory of climate; a precursor of Johann Gottfried Herder. By ARMIN HAJMAN KOLLER. *Champaign, Illinois: Garrard Press*, 1937. 8×5½ *inches;* vi+128 *pages.* $1.75

In 1719 the abbé Du Bos published his 'Réflexions critiques sur la poësie et sur la peinture,' which brought him a great reputation and opened for him the doors of the French Academy. In it he advocated a theory of climatic control of the distribution of genius which places him in the front rank of "determinists." He argues that the burgeoning of genius in certain "illustrious ages" in different countries cannot be explained on "moral" grounds, *i.e.* contemporary conditions, favourable opportunity, or patronage, from which he deduces that it must be due to fundamental differences in the quality of the air. The arts, he claims, are limited to the latitudes between the 25th and 52nd parallels and are confined to Europe and its shores with the particular exclusion of Spain: a parochial view with which few would concur. The obvious contrasts in intellectual and even physical characters that exist between peoples dwelling under different climatic conditions are then paraded naïvely as evidence for the hypothesis, the differences between negro and Russian being quoted in illustration. The factor of heredity is pronounced inoperative or irrelevant on the grounds that both are descendants of Adam. The rise or the decline in physical or intellectual vigour and in artistic output in any country is ascribed to some undefined change in the nature of the air, which is duly proved by the decline in artistic output and in physical and intellectual vigour. The "Réflexions" were, in fact, an early instance of a contemporary weakness for pseudo-scientific theorizing on inadequate data and with inadequate training or experience.

Dr. Koller has gone to great trouble in presenting a carefully documented account of the Abbé's theory, for which he appears to have a deep respect, and in tracing its influence, which was slight, on the views of later critics of art and poetry. The book makes a contribution to the history of criticism in the liberal arts, but to the climatologist it is a warning of how gravely awry the current of ideas can go when divorced from reality. A. A. M.

AFRICAN ODYSSEY: the life of Verney Lovett-Cameron. By W. ROBERT FORAN. *London: Hutchinson & Co.*, 1937. 9½×6 *inches;* 390 *pages; illustrations and route-map.* 18*s*

To all who have given serious attention to the story of African exploration the name of Verney Lovett-Cameron is a household word, and there is little fear that his great exploit of crossing for the first time the whole width of the Southern limb of the Continent from east to west will ever be forgotten. Therefore the present author's (or editor's) dictum that Cameron's name "is too often overlooked and but rarely accorded its rightful place among those other African explorers during the last century" is correct in a limited sense only. If Cameron's name is less known to the general public than some others of the great explorers, the cause is no doubt that the journey, valuable as it was for unfolding to geographers some of the darkest regions of the interior, lacked any very spectacular element, and the explorer's simple, straightforward narrative made no great appeal to lovers of sensation. It may therefore be questioned whether the

present book was specially called for, since nine-tenths of it are taken up with a condensed version of Cameron's narrative, told in his own book 'Across Africa.'

Were the claim of the book to be a "Life" of Cameron better justified, it might have filled a certain want, for the personality of the explorer may have been inadequately appreciated by the public, because of his excessive modesty. But when we find the whole story, apart from the African episode, compressed into the first ten and last nine pages, we gain no very close insight into that personality, though the sterling qualities which carried the explorer through so many dangers and obstacles are rightly insisted on. Major Foran has had access to Cameron's original journals, kept throughout his three years in Africa, but, so far as can be made out, the copious extracts are for the most part to be found almost word for word in the original published narrative.

Major Foran has an extensive personal knowledge of Central Africa and is able occasionally to add explanatory notes of his own. Some of the statements made in his preface are open to criticism. In saying that "even to his tragic death Livingstone contended that the Lualaba was the Nile and not the Congo" he overlooks the misgivings expressed in the 'Last Journals' that the rivers explored might belong to the Congo system. Baker, again, though he thought the Albert Lake far larger than it is, was not "firmly convinced" that it was one piece of water with Tanganyika. He even qualified the ideas of a connection between the two as "vain theories," and showed none on his original map, though later he quoted native reports suggesting that one might exist. And it is hardly correct to say that, when foiled in his attempt to complete Livingstone's work by tracing the Lualaba to the sea, Cameron "turned his attention to the Zambezi, and discovered that grand river's true sources." When compelled to take the slavers' route to the west coast along the Congo–Zambezi water-parting he did sight at a distance one of the latter's principal headstreams, but this was not the outcome of any definite search for the sources.

The details given in the first chapter about Cameron's family and forbears are of interest, while his later efforts for the development of southern Central Africa are very briefly sketched in the last. The book contains a portrait of the explorer on his return from the great journey, and others of his grandfather, Colonel Hector Cameron, and his wife. Most of the other illustrations are from photographs of the country on or near the traveller's route, but many of them show it under conditions very different from those of the seventies of last century. We can hardly endorse Major Foran's regret that the original book had to depend on woodcuts rather than photographs for its illustrations. One is sometimes disposed to think that the former method had its own attractions, and to regret its passing. E. H.

GENERAL

SYSTEMATIC GEOGRAPHY. Part 1. World Relations. By MARGARET S. WILLIS. *London: George Philip & Son*, 1937. 9 × 5½ *inches;* xiv + 300 *pages; illustrations and maps.* 5*s* 6*d*

This book, according to the preface, is intended for Higher Certificate and University Scholarship Candidates and also for first year university students. It forms the first of two parts—the second part on Regional Geography has yet to be published.

There is an enormous amount of material packed into it. The chapters are devoted to the following subjects: mathematical geography and cartography, the Earth, the oceans, climate, biogeography, man, world trade and its commodities, the history of geographical discovery. The information given is reliable and generally clear, and the student will certainly find much of what

he requires for the examinations specified in a concise and compressed form. The diagrams are clear and have been drawn for the book. The section on soils is very useful.

The main criticism however is that the book tries to cover too much. If it is designed for first year university students, fuller treatment should have been given in all sections, and references to other works should have been added. For the pre-University candidates it will undoubtedly be a most useful revision book, but unless the younger reader is careful he may easily fall into the error of thinking he knows, for example, a lot of geology, when he has mastered the condensed accounts given. Chapters V, VI, VII, and VIII seem to the reviewer to be more useful than the earlier ones because the material is often of a less controversial nature. J. A. S.

GEOGRAPHY FOR TO-DAY. Book I. At home and abroad. (Prepared by a Committee. Editors: L. DUDLEY STAMP and L. S. SUGGATE.) *London: Longmans, Green and Co.*, 1937. $7\frac{1}{2} \times 5$ *inches;* xii + 244 *pages; illustrations and maps.* 2*s* 9*d*

FIRST STUDIES FROM GREAT BRITAIN. By C. C. CARTER and C. A. SIMPSON. (Book I. The world of man. Edited by C. C. CARTER.) *London: Christophers*, 1937. $7\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xvi + 201 *pages; illustrations, sketch-maps, and diagrams.* 2*s* 9*d*

THE BRITISH ISLES. By A. R. BARBOUR SIMPSON. *London: G. Bell & Sons*, 1937. $7\frac{1}{2} \times 5$ *inches;* x + 148 *pages; illustrations and maps.* 2*s*

AN INTRODUCTION TO GEOGRAPHY ('The New Approach.' Book I.) By J. C. HILL. *London: Oxford University Press*, [1937]. 8×5 *inches;* 96 *pages; illustrations and maps.* 1*s* 6*d*

The first two of the above text-books are similar in intention, each being the first of a series of four designed to meet the requirements of the School Certificate. The first deliberately avoids "the formal treatment of the 'grammar' of the subject," and seeks to proceed from the general to the particular. Emphasis is placed upon contrast and comparison of the home district with other environments, the book covering the British Isles and the main regions of the world. These are treated chiefly from the point of view of the manner in which the inhabitants of these regions earn their livelihood, and facts of physical geography are dealt with as they are encountered. The sections are mainly descriptive, and the reader feels that explanation is being postponed to a later book. Stress is laid upon the use of photographs and maps, though the latter are dealt with very slightly. The text is on the whole written in a clear, if not very distinguished, style; some sections, *e.g.* the farmer's year in East Anglia and the function and growth of London, are particularly arresting. The illustrations are good.

The authors of the second book have restricted their subject to the British Isles. Unlike the author of the first, they have from the beginning based it upon a comparatively detailed exposition of the principles of physical geography. The earlier chapters deal lucidly with the features of mountains, rivers, coast lines, and the climate of Britain. The later chapters deal with agriculture and industry, and set out the fundamental factors in the growth of settlements and communications. A student who has mastered this book should be well equipped to proceed to the study of less familiar environments.

Mr. A. B. Simpson's book is also designed for school certificate students, but apparently at a later stage than the preceding text-books, and to assist the teacher, as he rather infelicitously puts it, "to get the prescribed knowledge into the pupil's brains in such a way that it can be readily extracted by the examiners." Actually, the text is much better than might be expected from this

remark. It contains a great deal of detailed information particularly in the subject of economic geography, clearly set out and apparently well up to date. As a general survey of the economic development of the British Isles to-day it should usefully complete the studies of older pupils.

The 'Introduction to geography' is planned as a first approach to the subject. A minimum of fact is conveyed in a series of "stories," mainly built around the lives of animals, and leading up to a general idea of climatic regions. The style is colloquial, and the telling of the stories not inspired. G. R. C.

THE STORY OF TWENTIETH-CENTURY EXPLORATION. By CHARLES E. KEY. *London: George G. Harrap & Co.*, 1937. 9×5½ *inches;* 286 *pages; illustrations and maps.* 7*s* 6*d*

There has been a remarkable amount of exploration during the last thirty-six years; so much, in fact, that a 280-page book about twentieth-century exploration must be compactly written or else incomplete. Mr. Key has done what he set out to do remarkably well. He has made a painstaking research into recent travel literature and produced a simply written, well-proportioned précis of the whole. To avoid making his book a dry record of facts he gives, every now and then, a full description of some interesting or exciting event.

The book is arranged geographically rather than chronologically. The first chapter begins with Colonel Fawcett and ends with Dr. Hamilton Rice's journeys of 1924–25. The second, dealing with Asia, goes back to the journeys of Sven Hedin and Sir Aurel Stein, and brings the story up to recent years again with the crossing of the Rub' al Khali and the adventurous travels of Miss Freya Stark.

The Polar history is divided up in most arbitrary fashion. There is "The conquest of the North Pole." Then, "The home of the blizzard"—Scott, Mawson, Charcot, Shackleton. After that "The conquest of the South Pole," Amundsen, Scott, Byrd, and Ellsworth. And then back to the Arctic again—from Amundsen to Gino Watkins. "The conquest of the North West Passage" comes last of all, linked with the work of Stefansson and Wilkins. But the object of this, clearly, is to divide up the whole story into little plots which the young student of exploration can explore one after the other, and for him it will undoubtedly prove a most useful book. J. M. S.

FLYING AROUND THE WORLD. By BOLIVAR LANG FALCONER. *Boston, Massachusetts: The Stratford Company*, 1937. 8×5½ *inches;* viii+104 *pages; illustrations and route-maps.* $1.50

The amount of satisfaction to be derived from being the first person to travel round the world by air would probably vary in individual cases, but we can sympathize with Dr. Falconer on his failure to accomplish this feat within the time specified in his programme. He had hoped to make the whole circular tour within thirty days, starting from Dallas, Texas, on 8 May 1936, and passing over Europe, Egypt, Persia, India, Burma and the Straits, China, Japan and the Philippines; but on arrival at Manila he found that the connection had failed and thenceforward travelled by easy stages, reaching home eventually on November 20.

This book contains 104 pages of written matter interleaved with 102 pages of illustrations. Dr. Falconer himself contributes details concerning various localities, with an amusing anecdote here and there; and a sequel to his own share of the book is provided in an interesting account by Mr. E. H. Bryan, Jr., of the B. P. Bishop Museum, Honolulu, of a trip in a four-motored Clipper Plane from Honolulu to Manila. W. G. G.

THE MONTHLY RECORD

THE SOMERSET COAST

In volume 7, 1936, of the *Proceedings of the Bristol Naturalists' Society* Mr. O. D. Kendall describes the Somerset coast between the high ground west of the river Parrett and Brean Down. The present paper is somewhat limited in scope and deals mainly with Steart Point, Fenning Island, and Steart Island. The coast is flat and bordered by marshes and dunes. Shingle is generally scarce except on Steart Point, where it has built a short series of characteristic recurves. The historical data of changes in these three places have been analysed, and the separation of the island from the point, and the incorporation of Fenning Island, demonstrated. The author has carried out a good deal of plane-table work, especially on Steart Island, in recent years and precise details of its change of form are recorded.

The occurrence of "clay-balls," *i.e.* "pebbles" of clay due to rolling, has been noted and observed. They are ephemeral structures, and sooner or later disintegrate when dry.

Doubtless Mr. Kendall will follow this preliminary paper with one involving more extended work on the several features of interest on this shore. With his students he is able to make periodic surveys, and we may feel that this part of our coast is under close observation. Careful mapping of critical points; measurements of erosion, accretion, movement of channels, growth of marshes; and extended observations of wave and current action in the Bristol Channel and the river Parrett are all important. These and other problems, *e.g.* ecological, afford Mr. Kendall great scope, and we hope shortly to see further evidence of his activities. J. A. S.

RIVER CAPTURE PROCESSES

In a paper entitled "Methods of stream piracy" appearing in the *Journal of Geology* for July and August 1937, Mr. I. B. Crosby points out that although many instances of stream capture or piracy have been described, comparatively little has been written upon the methods by which it actually takes place. He discusses these methods analyzing the two prevalent theories concerning the final act of piracy. According to one theory, the final act takes place suddenly by overflow of the upper stream into the valley of the lower or captor stream. According to the other, the capture takes place underground, and the water of the upper stream is practically all taken underground by the lower stream before the lower valley is actually cut back into the upper valley. The first theory is the older, but undue importance has been attached to the second in recent years.

Limiting the discussion to the capture of surface streams by surface streams or by subterranean tributaries of surface streams the author recognizes three distinct types: capture by headward erosion, which will eventually occur wherever adjacent streams are at markedly different levels and the tributaries of the lower are working back towards the upper stream; planation capture, a less common process due to the lateral cutting of one stream into the valley of another which may be about the same level; subterranean capture of surface streams, which is important in soluble rocks. The final act however of the first two types may occur underground if conditions are suitable.

The author illustrates these processes by examples from many river systems in the United States and concludes that the final act of capture only takes place underground in limestones, pervious sandstones, sand and gravel. In impervious

or insoluble rocks igneous or metamorphic, as well as in shales and clays, which are more abundant, the final act is nearly always on the surface, and does not occur as the result of water that may seep through joints. In this connection it is shown that waterfalls present a condition somewhat similar to that which exists when stream capture is imminent. In the case of a fall over a cliff of bare rock, water from the stream above the fall has an opportunity to enter cracks in the bed of the stream, flow through the rock, thus by-passing the fall, and come out as springs in the valley below the fall. In the great falls of the Yosemite region, where conditions are very favourable for observation, the author found no evidence that any appreciable amount of water by-passes the falls through the insoluble rocks.

SNOWSLIDE STRIATIONS IN GLACIER PARK, MONTANA

In the *Journal of Geology* for July and August 1937, Mr. J. L. Dyson contributes a paper entitled "Snowslide striations," a subject which has hitherto been almost absent from the literature of rock striations and avalanches. Near the eastern base of Mount Jackson in Glacier National Park, Montana, the top surface of a massive bed of limestone constitutes the mountain slope over a considerable area. On this surface, superposed on older glacial striae, is a set of similar but less numerous and clearly younger markings. These consist of straight grooves which trend in the direction of dip (down the slope), and at the lower termination of the several grooves is found a boulder which is apparently the tool that did the grooving. The boulders are limestone of the same formation as the underlying rock and range in size from small fragments to large blocks. The superposed striae extend parallel to the older grooves, some of them partially coinciding with the courses of the latter; but they appear quite fresh and unaffected by weathering. The unweathered grooves, sometimes as much as 35 feet in length, range from a mere trace to more than an inch in width, and have a depth up to $\frac{1}{4}$ inch. In nearly every instance the grooves are most prominent, particularly in width, near the boulders at their end, indicating that the cutting points of the boulders were blunted while functioning as the abrading tools.

The area is one from which the Blackfeet Glacier has fairly recently withdrawn; but though the older striae are undoubtedly of glacial origin, the amount of weathering which the limestone surface has undergone, together with the character of the vegetation on the morainic deposits, imply that the area could hardly have been ice-covered at any time during the last fifty years. From consideration of mechanical processes involved it would seem that a substantial thickness of glacial ice would be required to produce striae a quarter of an inch deep, yet the situation is such as to make the recent presence of thick glacier ice incredible. It is unlikely that boulders as small as those found here would have remained fifty years or more at the exact spot on which a glacier left them. During the short period of the year when the surface on which the boulders rest is not snow-covered water rushes down the slope from the melting snow above, and the steepness of the slope suggests that snowslides must be frequent and sufficient to displace the smaller stones. The smooth, steeply dipping surface forms, in fact, a natural sliding board.

The author, reviewing all the evidence available, comes to the conclusion that the grooves in question owe their origin to a recent snowslide, one which probably occurred in the winter previous to August 1936, when they were first observed. It seems, he says, that there is no essential difference in the striations produced by the scouring erosion of snowslides and glaciers, but a very great difference in the rapidity of the action. As those boulders which move farthest

are the least angular it appears that rock-tools embedded in the base of the snow-slide are, as glacier pebbles seem also to be, subjected to rotation during transportation. Hence the velocity is probably the factor which makes a swiftly moving snowslide able to produce in a second or two striations and grooves which a thick glacier would need much more time to engrave by reason of its cumbersome flow.

SOCIÉTÉ DES OCÉANISTES

We have pleasure in recording the formation in Paris of the "Société des Océanistes," which will devote itself to the study of Oceania in the widest interpretation of the term, and in all its aspects. The President is M. Louis Marin and the General Secretary M. R. Grunevald, and there is a distinguished list of officers and foundation members which augurs well for the future of the Society. The first meeting was held on 20 February 1937, when a paper was read by Dr. George Montandon on "Les races du monde océanien." This paper is published in the first number of the *Bulletin*, which the Society proposes to issue at intervals.

Dr. Montandon stressed the difference between the ethnological and the geographical and cultural conception of Oceania. Ethnologically, he considered that in addition to the island groups of the Pacific and Australia it should include Madagascar, Southern India, and the Malay peninsula and archipelago. He then proceeded to discuss the distribution and characteristics of the four great races found in this area. The pygmoid race ranges from Southern India (Kadar) and the Andamans through Malacca and the Philippines to New Guinea. The second great race is formed by the Vedda and Australoids, the former considerably scattered, with the largest concentration in India, the latter now mainly confined to Australia, though prehistoric traces have been found in Java and Tonkin. The negroid race is classified as Tasmanian and "Mélanésoide," the latter comprising New Caledonians, Melanesian islanders (said to be the nearest to the African negroes), Papuans, and the Sakalave race of Madagascar, though it is not yet determined whether the latter are of African or Oceanian origin. To the fourth great race, the brownish europoid, allied to the Mediterranean European, are assigned the Indonesian, Malay, and Polynesian peoples. Dr. Montandon also indicated several questions which require further research.

Other articles in this number include a study of the prehistoric industries in Oceania by M. R. Grunevald, in which he distinguishes palaeolithic and neolithic stages, particularly in Melanesia, and a brief survey of the floristic regions by M. A. Guillaumin. It is evident that the Society has entered an extensive and profitable field of research, and they may be assured of the sincere wishes of their British colleagues for their success.

Annual General Meeting, 18 October 1937. The President, Professor Henry Balfour, in the Chair.

The HON. SECRETARY (Mr. W. L. Sclater) read the Minutes of the Annual Meeting held on 19 October 1936, which were confirmed and signed by the President.

The PRESIDENT said: The first duty I have to perform this afternoon is that of presenting the Medals and Awards which have been allotted to various recipients. The two Royal Medals are those which are granted by His Majesty the King, our Patron, and are the most coveted geographical awards. Of these *The Founder's Medal*, with His Majesty's approval, has been awarded to Colonel C. G. Lewis in recognition of the extremely valuable services he has carried out in India and elsewhere. In 1911–12 he explored unadministered tracts of the North-East Frontier of India. From 1914–18 he was on war service in France and 'Iraq; during 1918–19 he made rapid but most valuable triangulation surveys of 'Iraq and Egypt. In 1919–20 he saw service in the Afghan War and was afterwards in charge of the Afghan Boundary Commission. In 1924 he was engaged in pioneer air survey, carrying out the survey from the air of the Irrawaddy Delta, a difficult region to survey by ground methods. Indeed, the success of this work was almost entirely due to Colonel Lewis's initiative. 1927–28 saw him in charge of the survey on the Turco–'Iraq Delimitation Commission. Here again Colonel Lewis combined older methods of survey with newer ones, using stereo-photogrammetry for the survey of areas away from the actual boundary. During 1928–31 he was in charge of the survey of Dir, Swat, Chitral, etc., difficult tribal tracts on the North-West Frontier of India, of which previous maps were extremely sketchy. Colonel Lewis has recently been appointed to the responsible post of Surveyor-General of India. He has throughout shown great originality in his methods and has vastly advanced the technique of survey. Like so much first-class work, Colonel Lewis's work has been carried out quietly and without ostentation or publicity. He has already inspired many of those engaged in survey work and has encouraged and advised many explorers. As he is unfortunately unable to be present to-day—he is already on duty in India—I will ask Professor Mason, who is intimately acquainted with Colonel Lewis's achievements, kindly to receive the Medal on his behalf.

Professor KENNETH MASON: I have known Colonel Lewis for the last twenty-seven years, throughout the whole period of his exploratory work in India of which the President has just given a summary. It gives me very great pleasure to receive the Founder's Medal on his behalf. He would, I know, ask me to thank you, Sir, and the Council of the Society, profoundly for the very high honour you have done him.

The PRESIDENT: *The Patron's Medal* has, with the approval of His Majesty, been awarded to Commander Lincoln Ellsworth, who has had a wide and enterprising experience of aerial navigation in both Polar regions. He began his polar travels in 1925, when with Amundsen he made an attempt with flying boats to reach the North Pole. In 1926 he was a partner with Amundsen in his trans-arctic flight in the airship *Norge* from Spitsbergen to Alaska. After two attempts which were unsuccessful, Ellsworth realized a great ambition when, accompanied by Mr. Hollick-Kenyon as his pilot, he made his memorable first flight across the Antarctic Continent from the Weddell Sea to the Ross Sea. That was a remarkable exploit requiring great courage and skill. The

flight was noteworthy also as a means of testing out the value and methods of inland air reconnaissance over the Antarctic and the possibility of making safe landings at intervals. New mountain ranges were sighted and other features of the heart of Antarctica were observed and duly noted. The great number of photographic views which he took from high altitudes will be of much interest when they come to be collated with those taken by the Graham Land Expedition at lower altitudes.

Commander Lincoln Ellsworth is a worthy recipient of this coveted medal, and I have great pleasure in handing it to him. When he takes the medal back to the United States I hope that he will also carry with it our greetings to our colleagues on the other side of the Atlantic.

Commander LINCOLN ELLSWORTH: Mr. President, conscious of the background of all the marvellous men who have received this award before me, it is not without a feeling of humility that I express my thanks for what you have done for me to-day.

The PRESIDENT: We now come to the other awards. *The Murchison Grant* has been awarded to Mr. Ronald Kaulback for his valuable exploration and survey of the Salween valley and south-eastern Tibetan area, during which he made a fairly detailed survey of some 50,000 square miles of almost unknown territory.

He had previously travelled with Kingdon Ward and was therefore well versed in the rigours of travel in those regions. On this last journey he has made important and wide-ranging surveys of little-known areas; and he has done more than that, because he has made contact with Tibetan and other natives, contacts of a very reassuring type. He has a flair for getting on with the native populations and winning their confidence, which speaks very well for him as a traveller. It is with much pleasure that I hand the certificate of the award to Mr. Kaulback.

Mr. RONALD KAULBACK: Thank you very much indeed for this most generous award. Together with the active help which has always been given me by the Society, it makes me realize more even than before what a great debt I owe you. I can only say that I shall do my best to repay some of it in further and more valuable journeys.

The PRESIDENT: *The Back Grant* is awarded to Mr. L. R. Wager in recognition of his important researches in mountain physiography, in which subject he is an acknowledged expert. His researches have been mainly carried out in the Himalayas and in East Greenland. But over and above the specific researches for which the Back Grant has been awarded to him, he has a long and distinguished record of exploration and field service in Greenland in connection with the first British Arctic Air Route Expedition in 1930–31; and again when he took an expedition to Kangerdlugssuak after he had accompanied Mr. Augustine Courtauld to the Watkins Mountains. Mr. Wager is a first-rate mountaineer and was a member of the Mount Everest Expedition of 1933. It is a privilege to hand to him this award and certificate.

Mr. L. R. WAGER: I thank you, Sir, and the Society for the award of this grant. I have always taken a very great delight in hilly and mountain regions, perhaps because I was brought up in the hilly parts of Yorkshire. As to why or how mountains take on their present form, how or when they were developed, have always been questions of interest to me. I reiterate my thanks to you, Sir, for this grant, especially as it will be an encouragement to future work in that same realm.

The PRESIDENT: *The Cuthbert Peek Grant*, the chief object of which is to encourage field research work about to be undertaken, rather than to reward

work already achieved, has been awarded to Mr. V. E. Fuchs, who has made extensive researches in the northern area of the Great Rift valley, chiefly around the shores of Lake Rudolf and in the Eastern Rift. Apart from survey work, his scientific investigations of the area are of a high order. His aim now is to pursue his inquiries farther south, and his coming expedition will be concentrated on Lake Rukwa. It is mainly as stimulation to a new venture on the part of one who has already established a name for himself that the Cuthbert Peek Grant is awarded to Mr. Fuchs.

Mr. V. E. FUCHS: To receive this award is indeed a great encouragement to carry out the work we propose to do at Lake Rukwa. Though it will be largely geological we shall not be competing with the local Geological Survey, for our side of the subject will be entirely non-commercial and they only too seldom get the opportunity to do such work. In fact, it is only through the assistance of this Society and a very few others that the work will be done at all. In thanking you for this award I would also like to thank you for your help in the past.

The PRESIDENT: *The Gill Memorial*, to come to the last of our awards, is allotted to Mr. George B. Barbour, whose researches into geology and geography of China have been very significant. Apart from his geographical investigations he has been largely concerned with important operations of great economic value. His paper in the Society's *Journal*[1] on the subject of the Great Boulder Dam, erected to pen back the waters of the Colorado river, and his detailed description of the Tennessee Valley Project,[2] give ample evidence of the grasp which he has of these great industrial ventures and of the natural features and phenomena which have to be overcome. Mr. Barbour's new work will take him to Cincinnati, and we may hope that there his practical mind may find a congenial outlet to lead him to further success.

In the absence of Mr. George Barbour I hand the certificate of his award to our Honorary Secretary, Mr. Wordie, and ask him to transmit it to Mr. Barbour.

Mr. J. M. WORDIE: It gives me pleasure to accept this award on behalf of Professor Barbour, whom I have known for many years; and it is particularly fitting that the Gill Memorial should go to one who has himself travelled and done so much of his best work in that very region which is associated with the name of the man in whose honour the Gill Memorial was founded.

The PRESIDENT then delivered his Annual Address, which is printed on pp. 489–97.

Visitors having withdrawn, the PRESIDENT appointed Brigadier-General E. M. Jack and Mr. Quintin Riley to act as scrutineers of the Ballot for the President and Council for the ensuing year.

The PRESIDENT, in submitting the Annual Report of the Council, said:

While the Ballot is proceeding we may consider the Report, which includes the balance sheet for the year 1936–37. The Report has already been circulated to every Fellow of the Society and I suppose it is fair to assume that every one of those present has read it from the first page to the last. It has been a custom to take the Report as read, and unless any one desires otherwise I assume that we follow that custom.

There being no questions or comments the Report was unanimously adopted by the Meeting.

Brigadier-General Jack reported that the scrutiny of the Ballot showed that the Candidates proposed by the Council had been elected unanimously.

The PRESIDENT: That brings to a conclusion our business to-day. But if I

[1] *Geogr. J.* 86 (1935) 498–504.
[2] *Geogr. J.* 89 (1937) 393–408.

may delay you for a minute or so I should like, in reference to that Ballot, to express my very cordial thanks to you for having given me the extremely high privilege of again presiding over this great Society. When I undertook office last year I was awestruck by the task before me. I had the prospect of having to try to live up to the precedents which had already been established by my very distinguished predecessors. To-day I am faced with an equally alarming prospect, that of living down the precedent which I have set for myself. I am guiltily conscious of various sins of omission inasmuch as I was enforced, by restrictions imposed upon me by the doctors, to be absent on many occasions when I should have been taking the chair at meetings and committees. I hope to mend my ways as far as I possibly can, and I beg most heartily to thank you for giving me the opportunity of at least making the attempt.

The proceedings then terminated.

THE ANNIVERSARY DINNER

The Anniversary Dinner was held at The Connaught Rooms on Monday 18 October 1937.

The Marquess of Zetland (Past President of the Society) received the company, which included, among the Guests of the Society, H.E. the Netherlands Minister and The Countess de Limburg Stirum, The High Commissioner for Australia and Mrs. S. M. Bruce, The High Commissioner for Southern Rhodesia and Mrs. Lanigan-O'Keeffe, Mr. David Williamson (U.S. Embassy), The Quartermaster-General of the Forces and Lady May, Field-Marshal Sir William Birdwood, Col. the Lord Wigram of Clewer and Lady Wigram, Sir Cosmo Parkinson (Colonial Office), Mr. J. C. Walton (India Office) and Mrs. Walton, Professor V. Tanner (University of Helsinki), The President of the Royal Anthropological Institute and Mrs. H. J. Braunholtz, The President of the Manchester Geographical Society and Mrs. F. B. Osborne, and Mr. and Mrs. Norman Salvesen.

After the Loyal Toasts, THE HIGH COMMISSIONER FOR AUSTRALIA (The Rt. Hon. S. M. BRUCE) said: I have been entrusted with the responsible and certainly very difficult task of proposing the toast of the Royal Geographical Society. There was one exceedingly simple way out of the difficulty, and that was to give you the story of what the Royal Geographical Society really is and of all that it has accomplished during the one hundred years of its existence. But those of you who are guests are placed very much in the same position as I am, in that before you came here to-night you ought to have found out all about the Royal Geographical Society and what it has done. I do know, because the Society has a most efficient Secretary and I have to the last detail the story which I could tell, though I am not going to do it in specific terms. I will however tell you a few of the things I have discovered in my researches through the briefs that were handed to me.

The study of those briefs was most interesting, and it was fascinating to go back and picture a group of men gathered together over a hundred years ago, and learn how the Society started as a dining club, as most of our British institutions do. This particular dining club divided the world up into a number of portions. I have a suspicion that the portions were somewhat vague when divided up, because one of the objects of the club was to have members each of whom knew something about a particular part of the world, so that they could triumphantly say that they had, collectively, visited nearly every region of the known world. That was their starting point.

To-day people can go to the utmost ends of the Earth without discomfort, in fact in the greatest comfort; you can even, I understand, now go to the unknown parts of the Earth almost with a reasonable measure of comfort. But in those days it was a wonderful thing that there could meet in a dining club in London a gathering whose members had visited every portion of the then known globe. The idea went so well that within three years they were able to found the Royal Geographical Society. It started under the most auspicious circumstances: the King was its patron from the very inception, and it could claim the title of "Royal" from the very first day of its birth. Its objectives, as I understand them, were to promote and diffuse a knowledge of geography and also—and this appeals almost more to me—to give encouragement to those engaged in exploration and discovery. It has gone on for those hundred odd years doing a great work based upon the principles for which it was established.

The methods that seem to have been employed over that long period are these: instruction is given to those who are going out on journeys of exploration and discovery; loans of instruments are made to expeditions; financial assistance is provided; and finally awards have been made to those who have carried out some very wonderful and intrepid adventures of exploration and discovery.

To-night, Sir, we are doing honour to one of your Gold Medallists, a name that now has a world-wide fame and reputation, that of Commander Lincoln Ellsworth. As his health is to be proposed later and he is to have the painful responsibility of replying to the toast, I will merely, if I may be permitted to do so, express to him, on behalf of my own country, our admiration for his great and intrepid flight. As to the admiration of the world, that will be expressed later by the proposer of the toast, but I would like to record our slight association with that last great flight of yours, Commander Ellsworth, by reminding you that you are not entirely unconnected with Australia, because from thence sailed the ship which came at a not altogether inopportune moment to your assistance. With that great performance of yours we had that slight association.

In Australia, we have also had associations with the Royal Geographical Society, and we venture to hope that we have carried out some of the ideals for which the Society stands. We are entitled, I think, to claim some small credit for exploration in another part of the Antarctic field—exploration carried out by Sir Douglas Mawson and those associated with him, and which led finally to the addition to the British Empire of some 3,000,000 square miles of territory, an area as large as Australia herself.

Having claimed that we were the discoverers of that great area we then proceeded to suggest that we should have the right to control it. I well remember when I was Prime Minister in Australia in 1925, the Australian National Research Council coming to me and suggesting that it was almost our birthright that we should control that great area. I listened to them, but I was not too sure their case was quite as sound as I would have liked it to be before I took the responsibility of putting the claim forward. So we proceeded with, and soon had in train, the arrangements for Sir Douglas Mawson's subsequent expedition, which went down to the Antarctic in 1928. It did so well that we thought we could claim the area with a clearer conscience. We proceeded to do so, and the process of establishing our control over that vast extent of the world's surface was finally concluded in 1936.

But we have also many other associations with the Society. I think the expedition that stands out over the last two years is the British Graham Land Expedition. With that we had very close and intimate association in Australia owing to the fact that its leader, Mr. J. R. Rymill, is an Australian by birth.

I should like also to stress the fact that we in Australia owe a great debt of

gratitude to the Society for the work it has been responsible for in New Guinea, which is now a dependency of Australia; also for the work in the South Seas in which you have played so great a part.

There is an even greater link that we in Australia have with your Society, and it arises from the fact that Australia and New Zealand are the two parts of the British Empire which have been added to that Empire entirely in accordance with the principles and the objects for which your Society stands. Looking back over the history of the British Empire, we must admit that perhaps some portions of the globe which we to-day possess we got because we wanted them, because we thought they would be rather good things to have, and we did not hesitate to take them, by force if necessary. But let us consider what happened in the case of Australia and New Zealand. If we go back to the days when Captain Cook sailed the seas and examine the influences which led to his great adventure in the Pacific, we find that behind all was the revival of interest in geographical and scientific knowledge which led the Royal Society to suggest the expedition to the Admiralty. Accompanying Cook on the *Endeavour* were several scientists including Joseph Banks, and the object of the expedition was scientific discovery according to the principles for which you in this Society stand. That was the inception of Cook's expeditions which were subsequently followed by the expedition under Phillip who landed on Australian shores 150 years ago and claimed for the British Crown that great territory which to-day is the Commonwealth of Australia. But that Phillip went, and that Australia became part of the British Empire, is entirely due to the initiative which came from the Royal Society, initiative which was exactly on all fours with the ideals and principles for which you and your Society have stood ever since its inception.

Since then Australia has become a nation. Under the protection of Britain her people have been able to develop their country by manifesting that capacity for adaptation to environment and genius for self-government which is characteristic of British settlement all over the globe. There is perhaps little we could now ask your Society to do for us in Australia. But Australia has become a colonial power and has taken on responsibilities in regard to Papua and New Guinea. These responsibilities can only be discharged if the peaceful penetration into the unexplored parts of these great territories is accompanied by the development and application of a scientific native policy, based upon the welfare of the natives, in fact upon all the best principles that have been established in a considerable measure through the initiative of your Society.

Well, Sir, in this task we are undertaking we know we have your support. We have also the benefit of all that has been discovered and achieved by previous expeditions which you have so materially assisted in sending out to different parts of the world. To-day we start with the advantage of all these things and with the realization that in dealing with great areas with native populations we cannot expect to be successful if we accept, as has sometimes in the past been accepted, that what is good for the European is necessarily good for the native. We have to apply all the knowledge and understanding of those great problems which have been brought to light by the great work which explorers and scientists have been enabled to accomplish through the encouragement and assistance of your Society. For all that we express to you our sincere thanks.

This toast is one which we have to remember concerns a great Society, one that has gone forward over the period of more than one hundred years and has won for itself an established position and world-wide recognition. I am certain that every one of you will drink to this toast with an appreciation of the great service the Society has rendered throughout its history and with a sincere wish

in your hearts that it may go forward and may long endure to carry on the great work for which it is responsible.

I give you the toast of the Royal Geographical Society, coupled with the name of its Chairman for to-night; and in giving you the toast coupled with that name, I am sure it would be your wish that I should express our sincere regret that the President, Professor Henry Balfour, is not present, and our heartfelt hope that he will soon be completely restored to health.

The CHAIRMAN in responding, said: You will all regret, as do I, the circumstances which have been responsible for my presence in the chair this evening. Happily, Professor Balfour is on the high road to recovery from the indisposition which has recently incapacitated him, and while on medical advice he has refrained from attendance to-night, he was able to preside at the Annual General Meeting of the Society this afternoon, and it will be your unanimous wish that I should convey to him your hope that he will now achieve a speedy restoration to complete health.

May I express to the High Commissioner for Australia my appreciation of the terms in which he has proposed this toast. As he pointed out in the course of his speech, the British Empire has staked out for itself great claims in the Antarctic regions, claims that have been made possible by the enterprise and endurance of British (and of course in that term I include Australian) explorers in the past, but claims which it behoves us to justify by continuing our work in those remote and somewhat forbidding regions. Such a piece of work, as Mr. Bruce reminded us, has recently been carried out in British Graham Land, and I feel sure that, while that particular piece of Antarctic territory is situated in the sector of the Falkland Island Dependencies and is therefore the concern of the people of the United Kingdom, Mr. Bruce's fellow-countrymen, and his neighbours in New Zealand, will be prepared, whenever necessary, to carry on similar work in the Australian and Ross Sea sectors of the South Polar regions. Meanwhile, I would remind you that you will have an opportunity of hearing at first hand an account of the work in British Graham Land at the opening meeting of the Society on November 1. That great enterprise, which may be said to have been brought to a successful conclusion when the *Penola* arrived at Portsmouth on August 10 last, having sailed the greater part of the way from South Georgia, has to its credit a very considerable achievement in the shape of a survey. It has provided us for the first time with a frame for the glimpses of the country which have been obtained by the flights of Sir Hubert Wilkins and Lincoln Ellsworth (whom we are happy to have with us this evening and who has been the recipient of one of our gold medals) and a frame also into which we can fit the systematic photographs taken from the air by the members of Mr. Rymill's party.

Now may I just turn for one moment from these distant and rather desolate regions to those vast mountain ranges rising on the fringes of Central Asia which provide so formidable and so irresistible a challenge to man? In doing so I cannot refrain from conveying to our German cousins the sympathy which all of us must feel for them in the disaster, involving the loss of seven German and nine Sherpa lives, which overtook them in the course of their gallant attempt to reach the summit of Nanga Parbat last June. These things excite our sorrow and evoke our regret. But neither hardships nor calamities deter the adventurous from their onslaught upon the mountain; and to all such it will be a matter of satisfaction to know that on the occasion of the New Year celebrations in Lhasa the Tibetan Government handed Mr. Gould, as a token of their goodwill towards us, a document authorizing a further British expedition to Mount Everest during the year 1938.

You will also be interested to know that we have recently received applications from mountaineering clubs in four different countries situated in three different continents for permission to conduct expeditions to the Karakoram mountains during the coming year. It has not been found possible to provide facilities for expeditions on so great a scale in the course of a single season, but I am happy to be able to say that permission has just been accorded to the Alpine Club of America to conduct an expedition with the object of climbing Mount Godwen Austen, known to many of us as K_2, an expedition which will be conducted during the coming year.

It is perhaps with legitimate pride that we recall the fact that it was a Past President of this Society, Francis Younghusband, who fifty years ago on his first great journey from Peiping to India discovered the Aghil pass. It would seem that, with the possible exception of Grombchevski, the pass has not since been visited until the jubilee of its discovery was celebrated this year by the expedition under Tilman, Shipton, Spender, and Auden, who have not only mapped the pass but have filled in a great many of the gaps in our knowledge of the whole of the Shaksgam area. In saying that I am not detracting in any way from the admirable work which has been done in that part of the world by Mason in 1926, by Spoleto in 1930, and by Schomberg in 1935. Without their labours the task which the Society has recently undertaken of producing a reliable map of the Karakoram mountains would have been well-nigh impossible. The completion of their enterprise in producing this map has been largely due to the success of a conference held some nine months ago under the presidency of Sir Charles Close; and the result will be a production, to be issued very shortly, of which the Society may be justly proud: a map which will now be accepted as authoritative by that august body, the Survey of India.

Finally, you may not think it inappropriate that I should say one word with regard to the geographical activities of the members of your Council. Mr. Wordie, one of our Honorary Secretaries, has recently returned after discovering six new fjords in Baffin Land. Miss Caton-Thompson is about to set out for the Hadhramaut with a view to investigating, in collaboration with Miss Freya Stark and Miss Gardner, the city of Shabwa. And finally, Major Bagnold, a member of your Council who has been re-elected for a further term of service, proposes early next year to make a detailed study of the Gilf Kebir, that great plateau of the Western Libyan desert of which we have heard something in recent times, but whose interest is by no means as yet exhausted.

I venture to suggest that, with a directing body in such close personal touch with the exploration of the day and with the encouraging account which your President was able to give this afternoon of the hold which the Society has upon the interest of the public, we may say that all is well with us and that, as Mr. Bruce so kindly suggested, we may look forward to a future as valuable and as successful as I like to think has been our record in the past. On your behalf and on my own I offer to Mr. Bruce our cordial thanks for the charming manner in which he has proposed our health.

Colonel Sir CHARLES CLOSE, in proposing the toast of The Medallists, said: As you all know, there are two principal gold medals, the Patron's Medal and the Founder's Medal. They are of equal honour and dignity. The Patron's Medal is awarded, with the approval of H.M. The King, to Commander Ellsworth for his explorations in both Polar regions, Arctic and Antarctic; for his development of a technique, as we heard this afternoon, of exploration from the air in the Polar regions; and, in particular, for his magnificent flight of 2200 miles from Dundee Island to the Bay of Whales. Commander Ellsworth

intended it to be a non-return flight, and I believe he made no arrangements for going back. From the beginning he intended to get right across the Continent, and he succeeded. It was a fine adventurous journey, and he brought back much information, all of which is not yet fully worked out.

I ought to have said long ago that Commander Ellsworth began his polar work with Amundsen in 1925–26, and that in 1933–34 he made experimental attempts in the Antarctic culminating in this great flight which we all know about. You will agree with me that he is a worthy recipient of the Patron's Medal.

For the Founder's Medal we leave those icy mountains and go to India's coral strand, and there we are able to congratulate the new Surveyor-General of India, Colonel C. G. Lewis. This is only the second time that this Society has awarded one of its gold medals to a Surveyor-General of India: the Victoria Research Medal was awarded to Sir Sydney Burrard in 1913. It is true that Captain Ryder received the Patron's Medal in 1905, but he was not Surveyor-General then. When you consider that the Survey of India has been in existence for some 150 years, and that we have only awarded a gold medal twice to a Surveyor-General, you will realize that we have not overdone it in that particular line. We are careful, as a rule, not to award medals to officials unless there is very exceptional reason for so doing. Now Colonel Lewis as far back as 1911–12 did good exploratory work in the little-known and difficult Miri country. After that we find him at work in the Near East and in charge of the survey on the Turco–'Iraq Delimitation Commission. He saw service in the Afghan War and was afterwards in charge of the Afghan Boundary Commission. Perhaps his most interesting piece of work was the survey from the air of the Irrawaddy Delta. There is no more suitable ground for survey from the air than a delta or estuary or swamp. Better work can be done from the air, and done more quickly, than on the ground. I am quite sure you will agree with me that Colonel Lewis deserves special recognition, and I will add to what I have said before about his geographical labours by mentioning that he has been in charge of the survey of difficult hill tracts and has taken great interest in the training of surveyors in the representation of mountain and glacier forms. Colonel Lewis is not here to-night and I will ask you to drink the toast of The Medallists, coupled with the name of Commander Ellsworth.

Commander ELLSWORTH, in responding, said: I feel very happy in being here to-night. It is also my pleasure to speak on behalf of Colonel Lewis, whose recent appointment as Surveyor-General of India has, unfortunately, made it impossible for him to be here this evening.

It has been said about some men who explore for science that making speeches is not one of their best qualities. It has been brought home to me on several occasions how uncommunicative we can be. In the second Antarctic expedition Wilkins and I returned to South America after the breaking of a portion of the 'plane, which could not be replaced, forced us to give up for another year. Somehow we must have neglected, during those last weeks after getting through the pack-ice, to send home the expected personal messages. Several days before we reached Montevideo the New York wireless interrupted us repeatedly during the evenings, asking if Ellsworth and Wilkins had any messages for their wives. The laconic reply of our radio man, who knew us all too well, was, "Regret Ellsworth in bed and Wilkins has nothing to say." You can imagine how enthusiastically that message was received! Another time during the crossing of Antarctica we were forced down on the great polar plateau where a raging blizzard held us prisoners in our sleeping-bags for three days. We had been *en route* for just one week. Hollick-Kenyon, my pilot, the most silent man

I have ever known, voiced what was in both our minds when he said, "I suppose this is all meant to try us out?"

When we came down more recently within 16 miles of the Bay of Whales and started on our 100-mile trek to find that elusive spot, Little America, I left my glasses in the 'plane. After the first week I found myself with nothing to do during the long nights but listen to the interminable gurgle of Kenyon's pipe, as he sat beside his bunk with all the literature, both good and bad, left at Little America piled neatly in stacks. Late one night as I lay in my bunk counting knots in the tent rope, his pipe became suddenly silent and, carefully laying down his book, he astounded me for the second time during our long journey with a sudden query: "Have you any dogs at your home?" However, if I go again I could not hope to find a better pilot or comrade.

After six Polar flights, four in aeroplanes and two in airships, my enthusiasm to go on still remains, with unabated faith in the aeroplane over the airship as a means of transport in polar exploration, where landing and taking off again quickly is a prime essential. To you men and women, who are the vanguard of those who carry the torch of progress in the exploration of our world, not for personal reward and glory but for the thing itself, and for the honour the Royal Geographical Society has done me, I am deeply grateful.

Mr. E. H. KEELING, in proposing the toast of The Guests, said: I really do not know why the President, who is unfortunately not here for you to question him, asked such a junior member of the Council as myself to submit this toast. Perhaps he supposed that any Member of Parliament could deliver a speech both eloquent and short. Speaking from bitter experience, I can assure him he was mistaken. But nobody on the Council could feel greater pleasure than I do in undertaking so honourable a task as proposing the health of The Guests.

The first name on my list of guests is that of H.E. the Netherlands Minister. We are doubly honoured by his presence to-night because it is his first public appearance in this country. Let me wish him the same success and the same popularity that our friend, his predecessor, enjoyed. I could not wish him more.

A fact about Australia which Mr. Bruce did not mention is that it was a Dutchman and not an Englishman who first landed on that continent. It is therefore appropriate that the name on my list next to the Netherlands Minister is the High Commissioner for Australia. Mr. Bruce is so well known in this country—as a Blue, as a Prime Minister, and as a High Commissioner—that I really need not say anything more about him. The speech in which he proposed the health of this Society is a sufficient guarantee that its members will drink his health with enthusiasm.

We have another High Commissioner here in the person of Mr. Lanigan-O'Keeffe, who is to reply to this toast. Southern Rhodesia is associated in our minds not only with the name of its founder, but with the geographical discoveries of Livingstone and the ungeographical romances of Rider Haggard. With this and much other material to work upon and, if I may say so, with his own ancestors to inspire him, Mr. Lanigan-O'Keeffe is certain to give us an interesting speech.

The United States Ambassador is unable to be present to-night for the simple reason that he is on the Atlantic, but he has sent a representative, Mr. David Williamson, one of the Secretaries of the Embassy, whom we are very glad to see with us, especially as it is an American who this year has received our Patron's Medal.

No public service has closer relations with this Society than the Army, and we are much honoured by the company of the Quartermaster-General to the Forces, Sir Reginald May. We also have with us Sir William Birdwood, the

Master of Peterhouse. His friends during the war were confident that he held a field-marshal's baton in his knapsack, but few of them could have guessed that it was also bulging with a mortar-board.

We are gratified by the presence of Lord Wigram, who, as Private Secretary to His Majesty King George V, was almost a Service in himself, and who, as Deputy Constable and Lieutenant-Governor of Windsor Castle, still stands near the Throne. Lord Wigram is here in a double capacity: he is not only guest but host, because he is a Fellow of the Society.

Sir Cosmo Parkinson from the Colonial Office and Mr. J. C. Walton from the India Office represent Departments which have rendered invaluable services to this Society, and I would mention in particular Mr. Walton, who, as head of the Political Department of the India Office, has on many occasions helped us very much with our Mount Everest expeditions.

Professor Tanner is a welcome guest from Helsinki. Last year I had the pleasure of accompanying the Public Schools Exploring Society on its expedition through Northern Lapland to the Arctic Ocean, and I take this opportunity of telling Professor Tanner that the cordiality with which his fellow-countrymen received that invasion of schoolboys was very much appreciated.

The presence of the President of the Royal Anthropological Institute is some consolation to us for the absence of his fellow-anthropologist, our own President. We are also pleased to see the President of the Manchester Geographical Society, and I hope, though without any great confidence, that a larger surface of earth and sky was visible when he left Manchester this morning than he could discern in London this afternoon.

Finally, I would like to give a special welcome to Mr. Norman Salvesen, whose firm in South Georgia rendered generous and priceless services to the British Graham Land Expedition.

I have now enumerated all our men guests, but I have said nothing at all about their wives. This banquet would indeed be dull without the ladies. I think the Royal Geographical Society has not devoted enough attention to the geographical importance of women. How is it that a poet, not an explorer, discovered "Earth's noblest thing, a woman perfected"; and how came it that it was a poet and not a student of physical geography whose researches revealed that

> "The world was sad, the garden was a wild—
> Till woman smiled"?

I give you the toast of The Guests, coupled with the name of the High Commissioner for Southern Rhodesia.

The High Commissioner for Southern Rhodesia: May I say that it is a great honour to me to have been asked to respond to this toast of The Guests, the most difficult task of the whole evening. If you ask why it is difficult, I suggest that any one of my fellow guests would find the same difficulty in thanking the Royal Geographical Society sufficiently for its hospitality to-night.

When I was told that I had to respond to this toast, I tried to get as much advice as I could as to what I ought to say, and I must confess that I got about as much as the Englishman in Dublin did when he tried to find Trinity College. He walked down Sackville Street, went up to a very young Irish policeman and said, "Where's Trinity College?" The policeman said: "I'll tell you. Do you see Nelson's pillar?" As the Englishman was standing up against the pillar and it is 160 feet high, he saw it and said so. Then the policeman said, "Well, never mind that at all."

Now, Sir, I do not know whether there is any connection between what Rhodes called "lust of horizon" and what others call "the spirit of adventure" and the Royal Geographical Society; but if there is, I would like to say that from my experience since I have been in England I find that the oft-repeated statement that the spirit of adventure is lost in England is not true. I have met hundreds of young men, and also hundreds of very fine young women, who are only too anxious to get out to the Empire and make their life there. But it is not as easy as some people think, because it is up to us who are responsible to those outlying countries to see that anybody who goes out to them gets a fair deal. It is not for us to encourage them to go out and then let them forage for themselves. We must be able to assure them that if they do go out we will make certain that, amongst other things, they are going to find a market for what they grow. Moreover we must see that their incursion into our countries does not create any injustice to those already there. These things may seem, and do seem to some people in England, very simple, but I can assure you they are very difficult. We are rather tired of hearing and reading platitudes. We want those interested to face facts.

It is not for me now to talk at length, but before I left Rhodesia I was always under the impression that it was difficult, if not impossible, to get something for nothing. I have been in England for about two-and-a-half years and I have found that it is one of the easiest things in the world. To-night, and, I may tell you, many other nights, I have had something for nothing, and I am very grateful for it.

First Evening Meeting, 1 November 1937. The President in the Chair

Paper: The British Graham Land Expedition, 1934–37. By Mr. John Rymill

First Afternoon Meeting, 8 November 1937. The President in the Chair

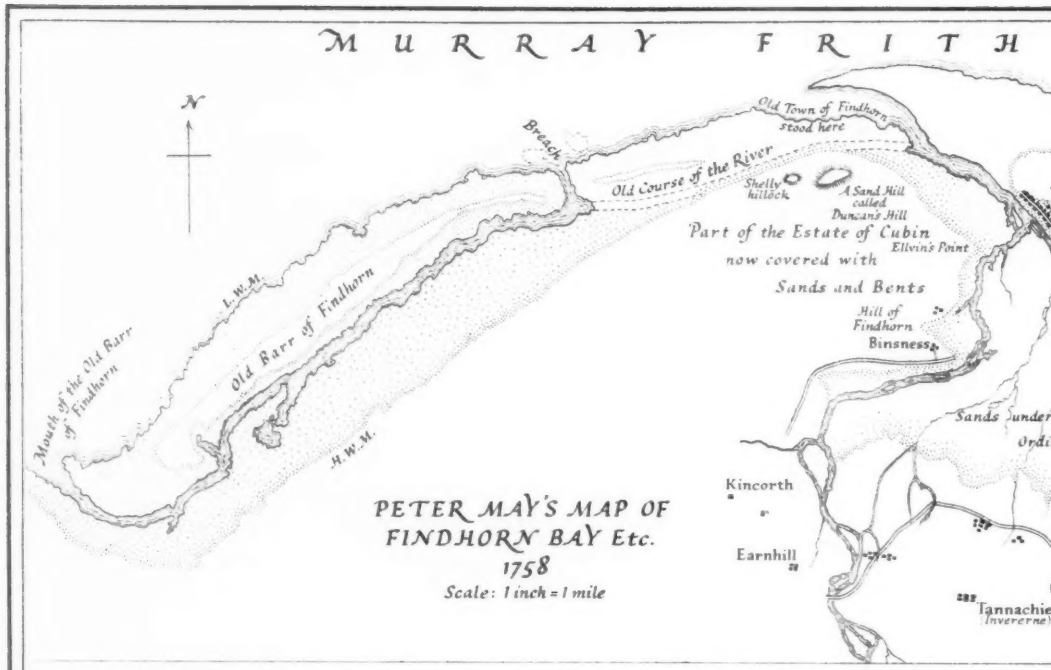
Paper: The Culbin Sands of the Moray Firth. By Mr. J. A. Steers

Second Evening Meeting, 15 November 1937. The President in the Chair

Elections: Mohammad Yunus Khan Afridi, M.A.; John Bicknell Auden, M.A.; J. C. Bahl, B.A., M.COM.; George Edwin Baker, C.B.E.; Evert Barger; Miss Joan Barker, B.A.; Hedley Fenwick Battey; Walter J. Beasley; Miss Mona Stanley Bent; Edward Ivor Bowen; Francis Lennox-Boyd (Royal Scots Greys); Ronald James Brech, B.SC.; John Gourlay Bridges; Harold Bertram Stanislaus Brownlow, F.R.S.A.; Mrs. Edith Helen Calderwood; William Durant Campbell, B.A.; The Countess of Carlisle; Cuthbert John Cayley; Mrs. Alice Chalmers; Douglas Chandler; Kenneth Harry Chapman, B.A.; Pashupati Chattopadhayan, M.A.; Captain F. Chilton; Leslie John Frederick Clarke; Miss Hilda M. Cobb; Senhor Armando Cortesão; Allan George Coulam, M.A.; Noel Andrew C. Croft; Miss Clara E. Crompton; J. E. Davie; Captain A. G. W. Dobbie, R.E.; Nicolas Francisco Dracopoli; Professor Daniel S. Dye; G. V. Fancourt; Major J. E. French, M.C.; Bernard C. Gadney; Mrs. Everard Gates; Captain William John Geddes, O.B.E.; Robert James Reginald Giblett, M.A.; Miss Phyllis Gross; The Reverend Thomas Hankin, B.A.; John Esdon Henderson; Richard William Hewson; Graham Holliday; John Hopkinson, D.SC., PHY.D., M.D.; Professor J. H. Hutton, C.I.E., D.SC.; Mrs. Celesta Hamer-Jackson; O. Johnson, B.A.; M. G. Kapadia, B.A.; Reginald Hugh Kiernan, M.A.; Louis Gaston Le Blanc, M.D., M.R.C.S., L.R.C.P.; Anthony Freire-Marreco; William Edmund Devereux Massey; Jason Chilton Matthews; William Frederick Mellor; Miss Sybil Mary Mellors; Captain Khan Bahadur S. R. Mody, K.I.H., F.R.S.A., F.R.E.S.; Mrs. Edith J. Monins; H. Ramsey Moore; Mrs. Mary Myers, B.SC.; K. M.

Nainan, M.A.; M. D. Nangia, B.A.; Miss Nishiebala Nayak, B.A.; Lt.-Col. R. H. R. Neale (Royal Signals); Harold Phillips; Gerald Walter Price, F.PH.S.; Sir Henry P. Price; Miss Pamela Raikes; Captain George Giles Emsley Raley, M.C., B.A.; Harry T. Richards; William Richards; Rosamond Viscountess Ridley, D.B.E.; Mrs. Barbara Rixson; George Whiteside Robertson, O.B.E., M.A., M.D., C.M.; George Arthur Rourke; The Rt. Hon. Earl St. Aldwyn; Ralph Erskine Scott; Walter Reginald Courtenay Shaw; Mrs. Helen Florence Sieger; Floyd S. Tangier-Smith; Harold Frederick Kynaston Snell; Harold James Spencer; George Martin Sprague, R.A.M.C., A.I.MECH.E.; P. B. Srivastava, M.A.; Robert Harold Arthur Staniforth; Roderick Syme; Lawrence Copley Thaw; Tan Poo Thein, B.A.; Kenneth Treherne Thomas; Paymaster-Lieut. Harry Thompson, B.A.; Captain Walter Anderson Venour; Bruce Wykeham Watkin; Trenham Desmond Weatherhead; A. W. H. Weir; Mrs. Lillian Weldon; Mrs. Francis Thorneycroft Wheen; Henry Lambert Widdup, M.A.; Alfred James Wilmott; Tom Wilson; Charles Eustace Owen Wood, M.INST.C.E.; Charles Henry Yeaman, M.INST.E.E.

Paper: The Land of Sheba. By Mr. H. StJ. B. Philby. (The seventh Asia Lecture)


MURRAY FRITH
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Old Town of Findhorn stood here
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Old Course of the River
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A Sand Hill called Duncan's Hill
Part of the Estate of Cubin
now covered with
Sands and Bents
Ellvin's Point
Hill of Findhorn
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Old Barr of Findhorn
Mouth of the Old Barr of Findhorn
H.W.M.
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PETER MAY'S MAP OF
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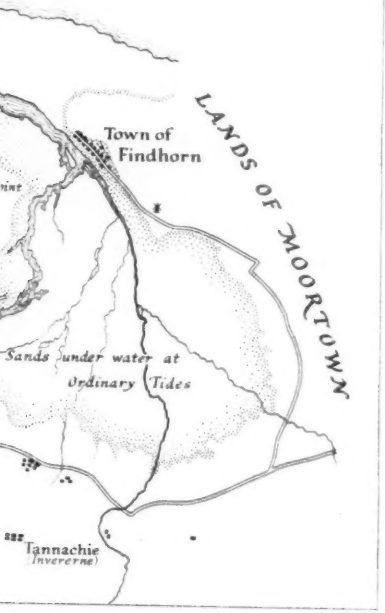

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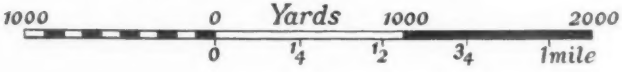

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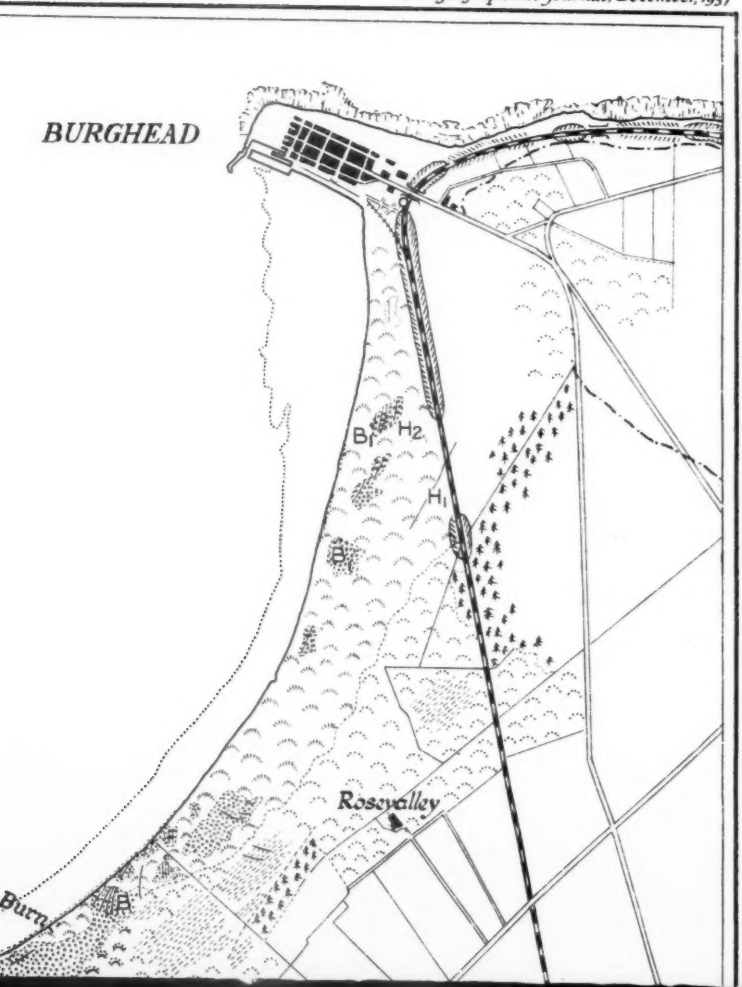
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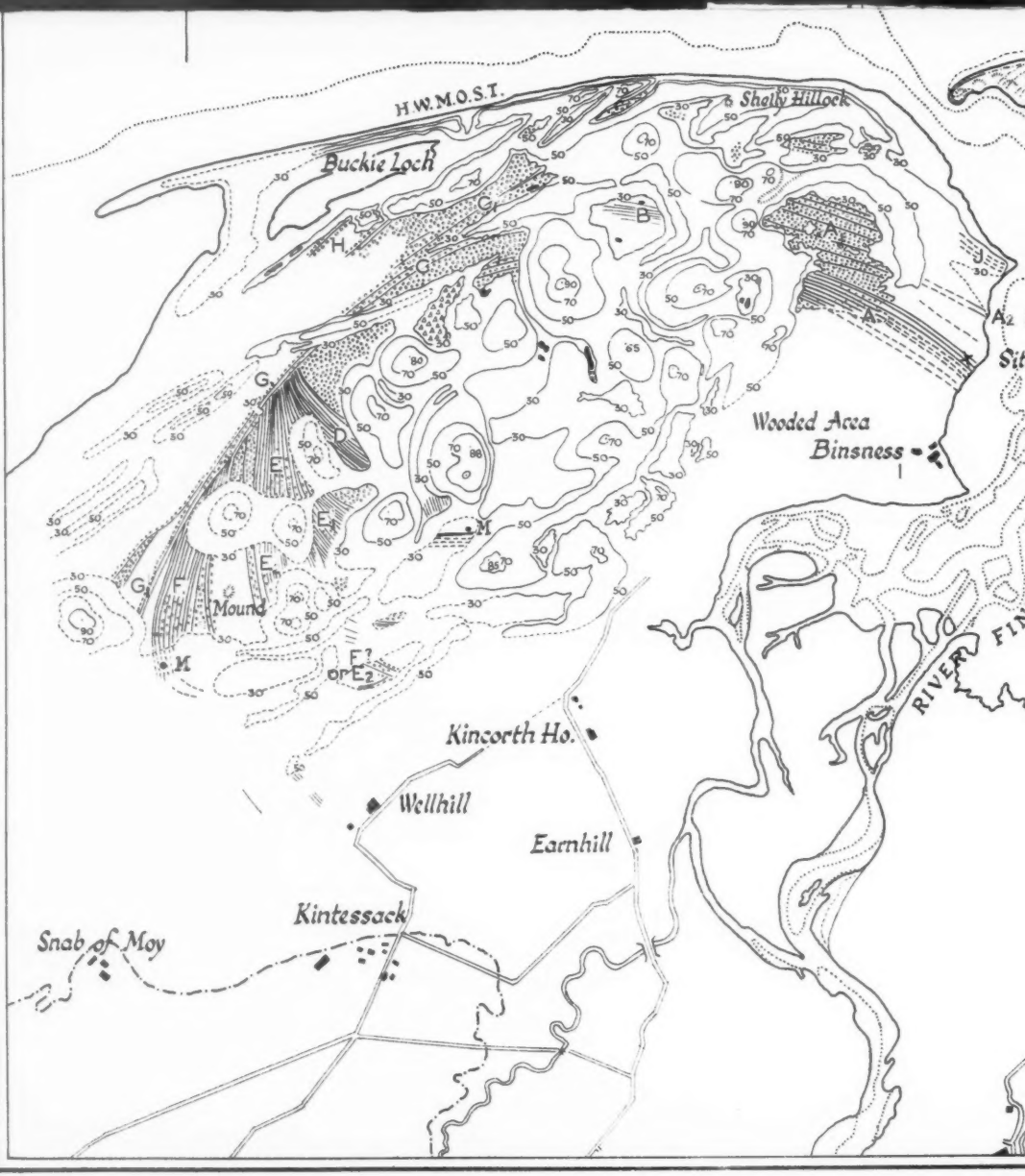
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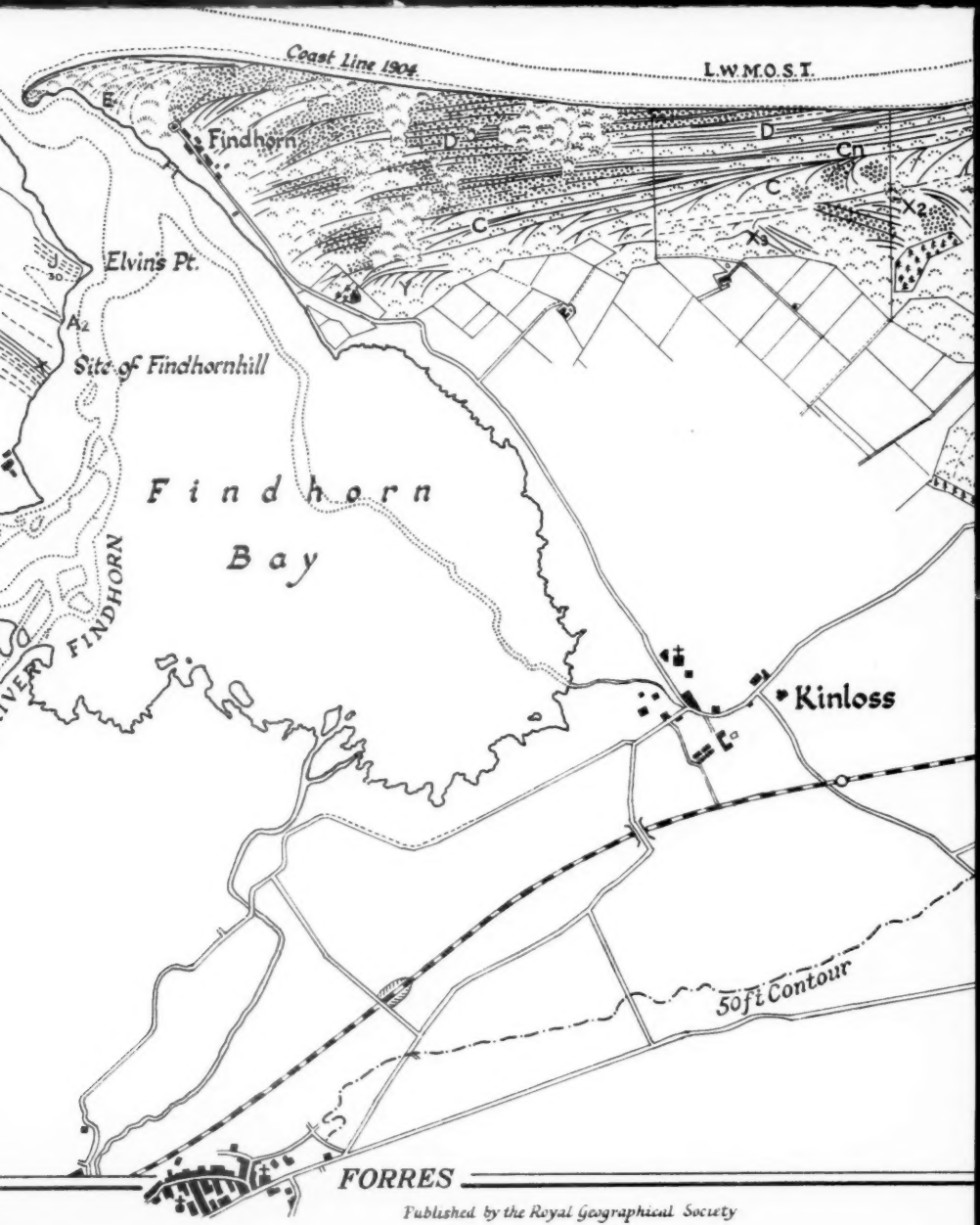

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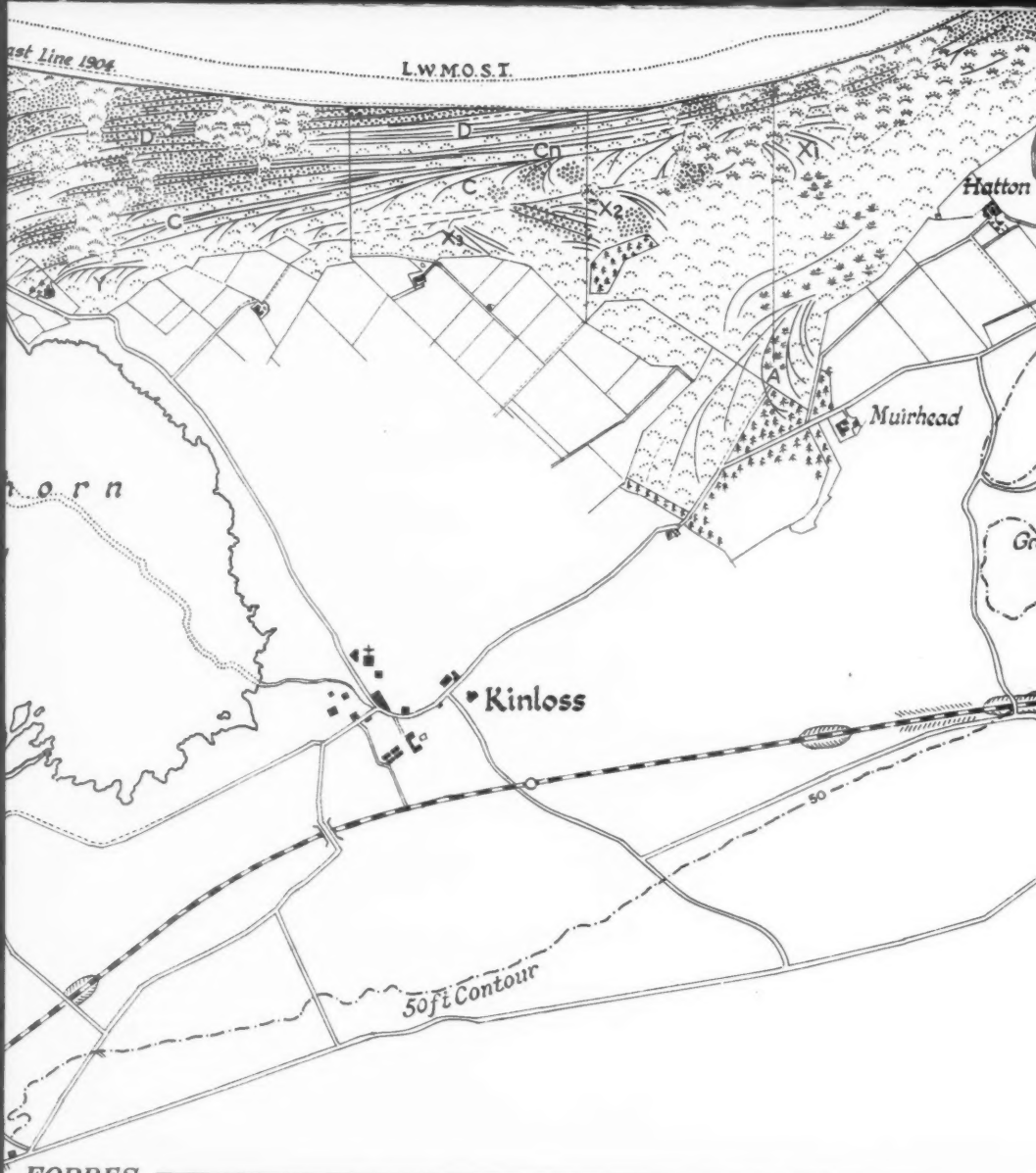

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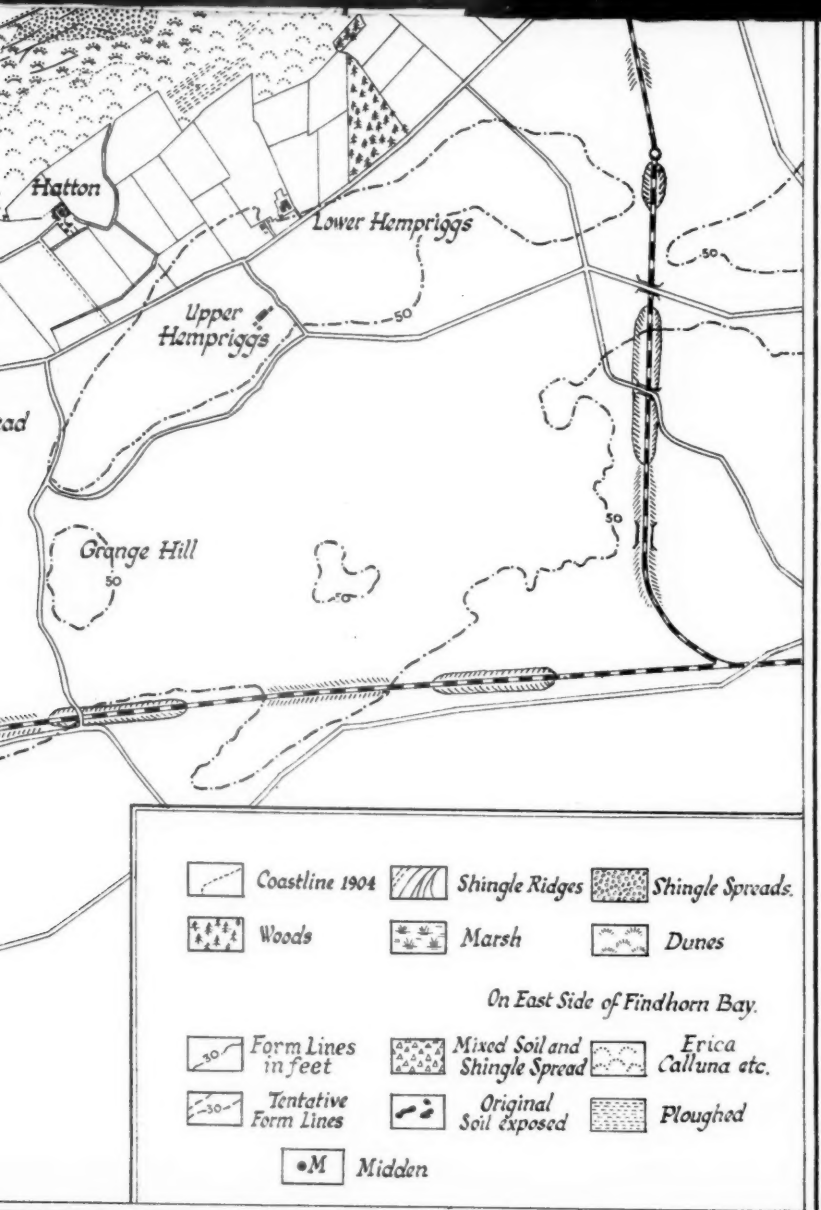

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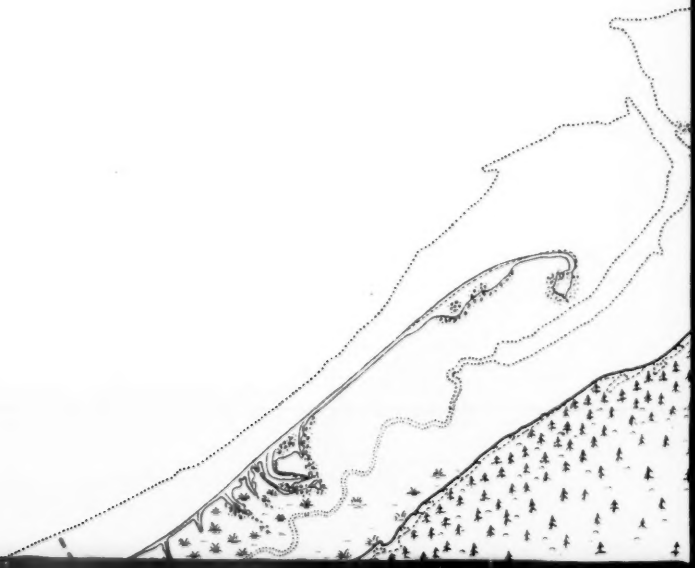

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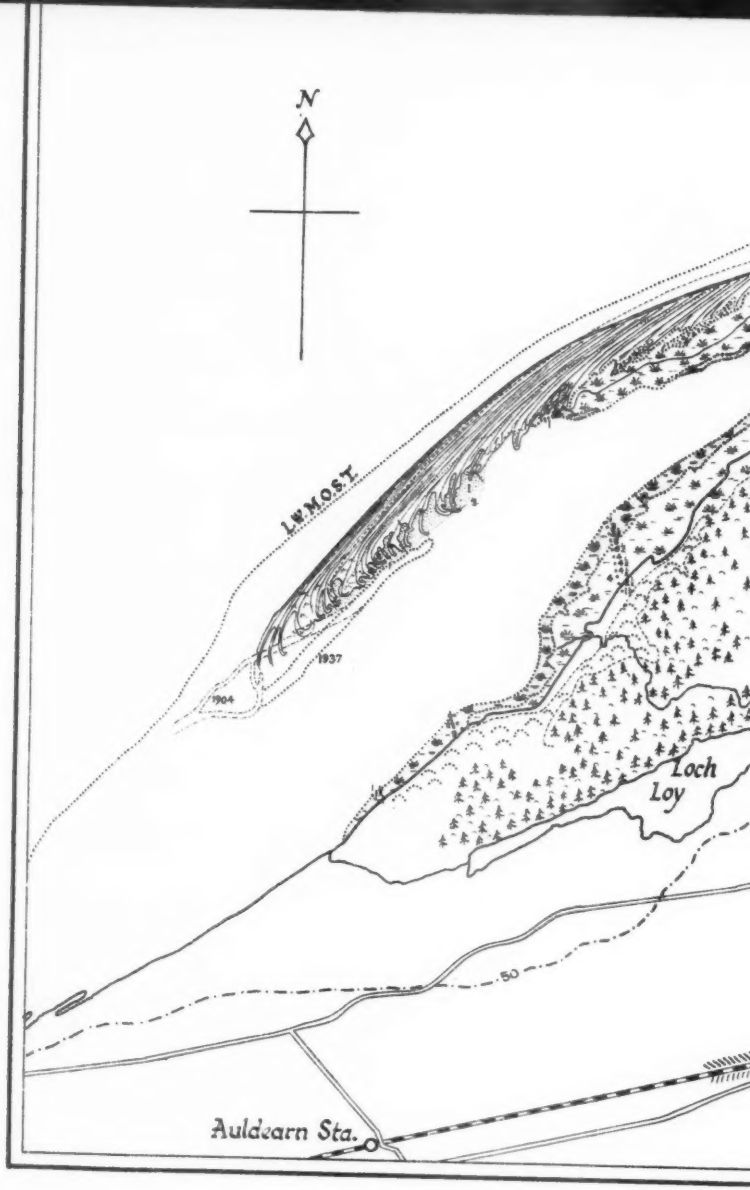
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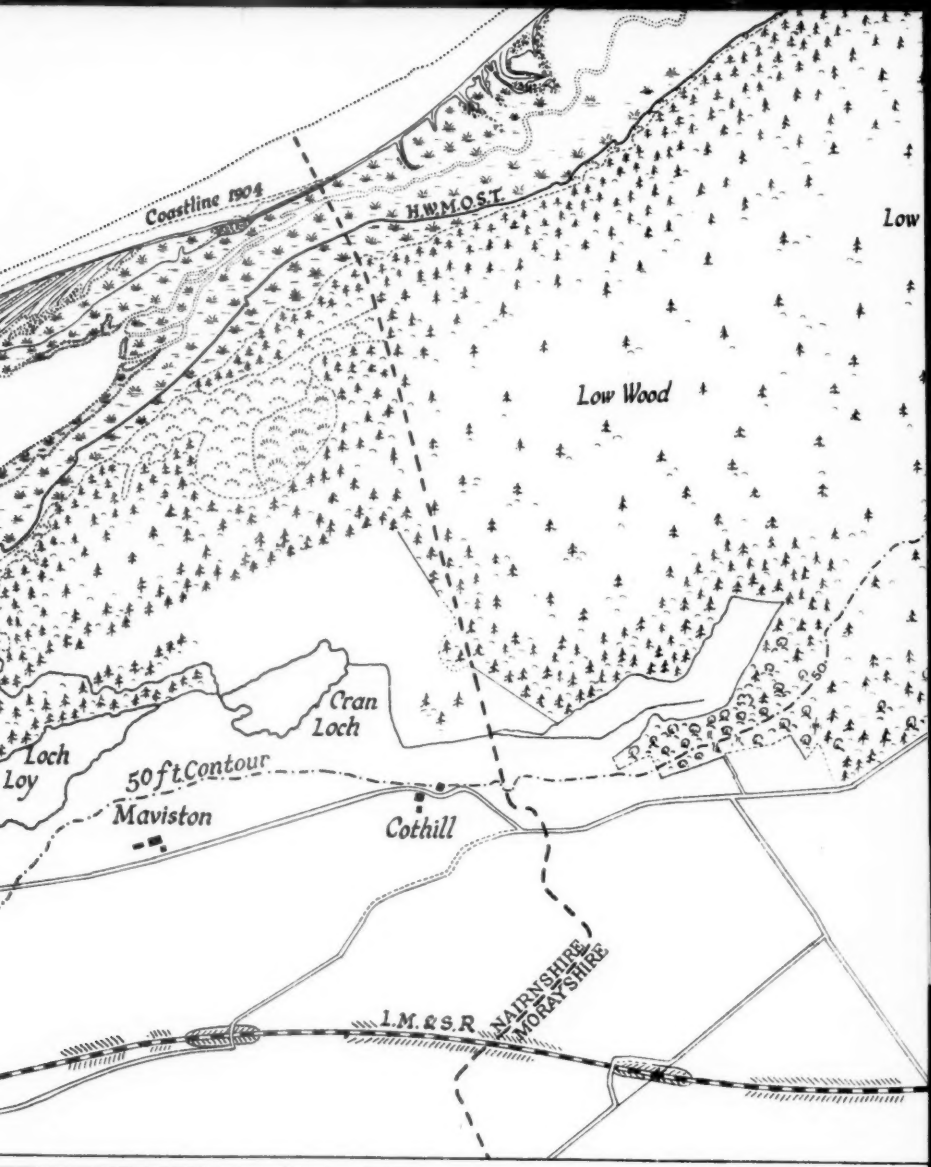

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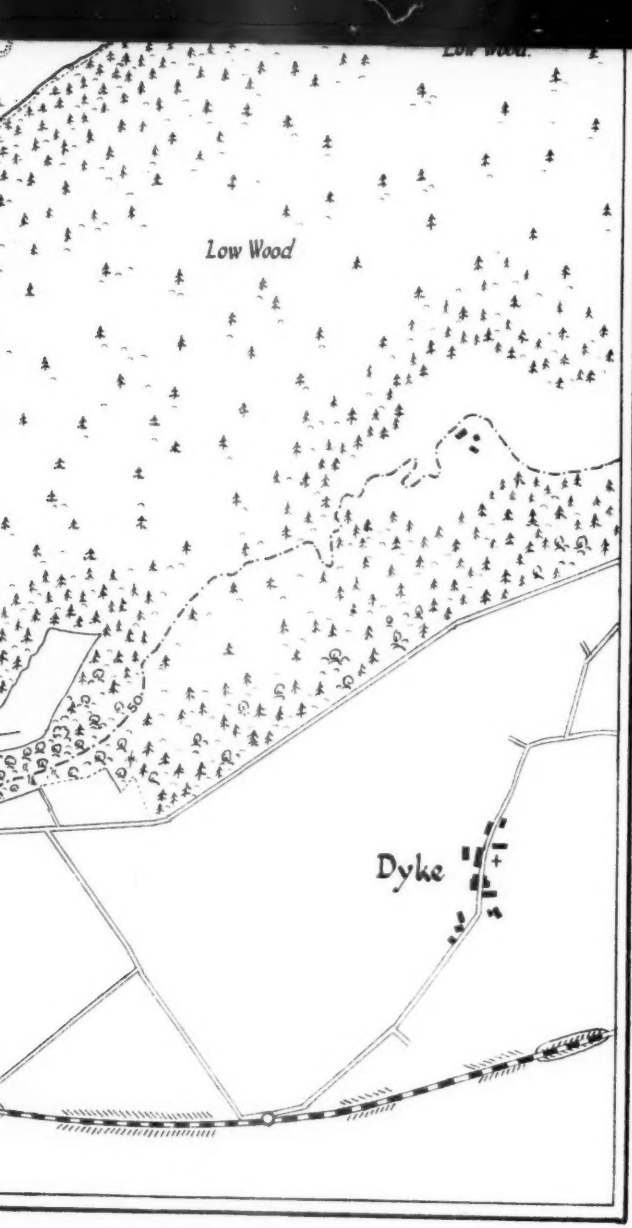
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